DOCUMENT RESUME

ED 182 919	EC 123 120

AUTHOR	Darby, Betty L., Ed.; May, Marcia J., Ed.
TITLE	Infant Assessment: Issues and Applications.
INSTITUTION	Washington Univ., Seattle. Western States Technical Assistance Resource.
SPONS AGENCY	Bureau of Education for the Handicapped (DHEW/OE), Washington, D.C.
PUB DATE	79
CONTRACT	300-77-0508
NOTE	240p.; Proceedings of conferences (1st, Seattle, WA, May 31-June 2, 1978; 2nd, San Francisco, CA, February 28-March 2, 1979)
EDRS PRICE	MF01/PC10 Plus Postage.
DESCRIPTORS	Aurally Handicapped; Cognitive Development; Cognitive Processes; Communication Skills; Downs Syndrome; *Evaluation Methods; *Handicapped Children; *Identification; *Infants; Mothers; Motor Development; *Neonates; Neurologically Handicapped; Parent Child Relationship; Screening Tests; Social Development

ABSTRACT

The book offers 14 papers presented at two conferences on assessment and intervention with handicapped infants, sponsored by the Western States Technical Assistance Resource. Titles and authors include: "Neonatal Diagnosis of the Neurologically Handicapped" (M. Coleman); "Principles of Infant Assessment" (J. Swanson); "Focus on the Parent-Infant Dyad" (J. Kelly); "Developmental Screening Overview" (J. Meier); "Legal/Ethical Issues in Early Intervention" (W. Dussault); "Early Motor Development--Assessment and Intervention" (M. Swanson); "Infant Cognition--Considerations for Assessment Tools" (B. Darby); "Communication Development, Assessment, and Intervention" (N. Nichols); "Social Development and Assessment" (P. Doyle); "Methods of Assessing Mother-Infant Interactions" (C. Ramey); "Assessment of Visually Impaired Infants" (R. DuBose); "Assessment of the Young Hearing-Impaired Child" (M. Thompson); "Infant Learning Program For Down's Syndrome" (V. Dmitriev); and "Early Intervention--From Research to Practice" (C. Ramey et al.). A selected bibliography is also included. (DLS)

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Infant Assessment:

Issues and Applications

Proceedings of conferences sponsored by the Western States Technical Assistance Resource, 1978-79.

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This document was produced under contract number 300-77-0508 from the Bureau of Education for the Handicapped, United States Office of Education, Department of Health, Education, and Welfare. The opinions expressed herein do not necessarily reflect the position or policy of the U.S. Office of Education, and no official endorsement by the U.S. Office of Education should be inferred.

Printed in the United States of America, 1979

Editorial assistance from Matthew Kangas
Typing by Cheryl Yates and Linda Floyd

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FOREWORD

The research efforts of developmental psychologists and the applied practices of early childhood educators have resulted in the recognition of the potential for increasing the responsiveness of the human infant's brain. These activities are providing information and prompting a great deal of investigation into the plasticity of the infant nervous system.

Information about the nature of infants' learning potential has great significance for those professional developmental clinicians and educators who work with developmentally disabled infants. If, as it appears now, the learning potential of the infant nervous system can be increased through training, it is reasonable to assume that infant intervention can increase the ability of the handicapped infant and that this could reduce the effects of the handicap on future adaptation. As will be discerned from the readings that follow, the earlier the infant with a handicap is identified and provided with educational services, the greater the change that may occur. Since it is important to identify the handicapped infant early, it is necessary to develop accurate, reliable assessment procedures.

Severely handicapped infants are usually identifiable during the neonatal weeks; however, identifying moderate and mild handicapping conditions presents a greater problem. The need for continuing development and refinement of assessment techniques for these populations remains crucial to early intervention programs. Achieving reliability in predicting a handicap will continue to be a problem, regardless of how advanced our assessment procedures are. If effective intervention services are provided, the infant may become less handicapped and perhaps appear not to be handicapped at all by school age.

Obviously, conducting extensive assessment procedures for all infants would be prohibitive and most likely unnecessary. However, a national program of screening and diagnosis for high-risk infants is needed. This would involve development of a uniform, systematic procedure for identifying at-risk neonates and a formally established relationship between screening, diagnosis, and intervention services for infants.

This volume, then, is primarily focused on the various facets of assessment of infants' potential. It is the product of the Western States Technical Assistance Resource (WESTAR), which provides program development assistance to the staff members of some twenty model preschool projects serving infant populations, funded under the Handicapped Children's Early Education Program (HCEEP) by the Bureau of Education for the Handicapped.

As a result of formal and informal needs assessments with the projects serving infants, a number of common needs emerged during recent years. To address those shared needs, WESTAR sponsored two infant topical conferences. The first conference was held in Seattle on May 31-June 2, 1978, focusing on assessment and intervention with infants with specific handicapping conditions. The second conference was held in San Francisco on February 28-March 2, 1979, addressing general issues relevant to assessment and intervention with handicapped infants. Available papers from both conferences, along with a bibliography of selected references on infant assessment and intervention, have been compiled in this proceedings document to serve as a resource for new and continuing infant projects within the HCEEP network.

Part 1 of this document deals with a broad range of issues related to early detection. Coleman describes the neonatal screening and assessment procedures which she feels are necessary for effective early detection and intervention. J. Swanson's contribution delineates principles for valid assessment while emphasizing the importance of including the parents as active participants in any assessment procedure. The importance of including both the parent and the infant in assessment and intervention is supported by Kelly's literature review of dyadic interactions. Meier reviews current screening methodology and recommendations for more efficient health care delivery systems which would eliminate the need for numerous specific screening programs. The first section closes with Dussault's discussion of the legal issues that apply to federally funded infant intervention programs, including protection of human subjects, informed consent, and accessibility and confidentiality of records.

Part 2 includes chapters which have practical applications for intervention programs. Since numerous books and articles on infant development exist, the focus of this section is not to provide a comprehensive overview of infant development. Professionals and paraprofessionals working with handicapped infants should have a thorough background in typical and atypical development. This knowledge is necessary in order to select appropriate assessment procedures which will in turn result in information that leads to designing, implementing, and evaluating an appropriate and effective intervention program. The first four articles in Part 2, by M. Swanson, Darby, Nichols, and Doyle, respectively examine motor, cognitive, language, and social development in relation to available assessment procedures. Ramey's article focuses more specifically on possible assessment procedures to employ with the parent-infant dyad. The following three papers, by DuBose, Thompson, and Dmitriev, deal with the assessment and management of three specific handicaps: visual impairment, hearing impairment, and Down's syndrome. The section concludes with Ramey's keynote address from the 1979 conference, which describes the results of a massive intervention program at the Frank Porter Graham Child Development Center, University of North Carolina, Chapel Hill.

NORRIS G. HARING, Ed.D.

University of Washington
September 1979

Part 1
Issues

NEONATAL DIAGNOSIS OF THE NEUROLOGICALLY HANDICAPPED

Mary Coleman

Extraordinary as it may sound, it is true that we are at a moment of medical history regarding mental retardation. After generations of regarding retardation as a fixed, immutable characteristic of the central nervous systems of patients with certain disease entities, this important assumption is now under serious question.

We are starting to explore the possibilities of actually changing the learning potential of a human brain by intensive, early intervention and comprehensive individual medical care. Our work is leading us to new knowledge about the plasticity of the infant nervous system. With a sense of wonderment, we are beginning to see children, labeled at birth as likely to be seriously retarded, begin to blossom and function at moderate, then mild, and in some cases, even normal levels of cognitive development. With a sense of humility, we are beginning to see the arrogance of previous "scientific" assumptions of inevitable retardation. With a sense of caution, we are beginning to realize the potency of the educational tools we are developing that can help to mold the brain of any human child toward a desirable (or possibly even undesirable) preselected goal. It is a challenging and exciting time to be in the field of infant education.

The underlying principles that have lead to these new developments have grown out of recent decades of experimental studies in animal behavior. Two very different types of animal behavior described in the literature are imprinting and learning. Imprinting, particularly well documented in birds, is the result of a single stimulus presented at a particular time early in development. This stimulus (e.g., the visual image of the mother) always elicits the same invariant response from the young animal (e.g., following the mother). The time period during which imprinting can occur is referred to as the critical or sensitive period. The behavior that follows imprinting can theoretically be distinguished from the behavior that follows learning. Imprinting can only occur during the sensitive or critical period, while learning can occur at any time in the animal's life. Imprinting behaviors are invariant and are always elicited by the stimulus, while learned behaviors can vary and may not always occur following the stimulus.

Between these two extremes in behavioral response to a stimulus are various combinations of the two which may apply to some of childhood learning. One example is the response patterns of the visual system, which, like imprinting behaviors, require an appropriate stimulus during a fixed period early in development in order to mature normally. However, the critical period may last considerably longer than in classical imprinting and the entraining stimulus requires more than one presentation, which is similar to learned behavior (Lund, 1978).

How the human infant learns is not fully known, but it may include a combination or variation of these two types of behavioral response. It is becoming clearer and clearer that the earlier stimuli are presented to the human brain, the more effective these stimuli are in enriching skills needed for later complexities of responses, especially in memory and learning. Increasing both the quantity and quality of stimuli presented for processing at early ages alters developmental patterns in the still-plastic infant brain. Thus, early diagnosis of any disability in the central nervous system is important so that compensatory, specially designed, infant stimulation therapies can be instituted to ameliorate the diagnosed disability.

Another important reason for early diagnosis of disease entities affecting the central nervous system is the institution of comprehensive, specific medical or surgical therapies for these infants, which may be an essential prerequisite so that the baby can have an adequate response to the educational therapies. For example, a partially deaf baby (such as a significant percentage of Down's syndrome infants) will not receive maximum benefits from auditory stimulation techniques. Superb medical care is available at major medical centers for diseases affecting the lungs, gastrointestinal tract and kidneys, but insufficient emphasis often is given to diagnosis and treatment of the various types of mental retardation--occuring in 1 to 3 percent of all liveborn infants.

In short, very early diagnosis of handicapped patients has now become paramount in neonatology. In this chapter, the medical diagnostic procedures that every newborn should have to detect handicapping conditions of the brain will be outlined. In neonatology, the general concept of "at-risk infants" has been developed to identify babies who need special follow-up and who may be candidates for infant intervention programs (Klaus & Fanaroff, 1973). Many hospitals have a high-risk nursery for special admission of these patients. We shall follow a baby through such an admission.

NEONATAL DIAGNOSIS PROGRAM

The story of Valerie starts with the obstetrical history of her mother. Valerie's 20-year-old mother had a "cold" with a fever during the first trimester, which is an indication that the child may be at risk for a handicapping condition (Table 1).

TABLE 1
OBSTETRICAL HISTORY FACTORS CORRELATED WITH "HIGH RISK" INFANTS

- Elderly primigravida
- Maternal diabetes
- Maternal fever or infection
- Third trimester bleeding
- Mother addicted to drugs
- Toxemia
- Premature rupture of membranes (over 24 hours)
- Abruptio placentas, placenta previa
- Prematurity or gestation over 42 weeks

Valerie was born after a normal labor and delivery, weighing 3900 grams (8½ lbs.). During labor and delivery there are a number of factors that suggest fetal distress, such as an irregular fetal heartbeat or a persistent fetal heart rate less than 120 or greater than 160 beats per minute. Meconium staining with a vertex presentation is another indication of fetal distress. Unusual presentations, such as breech, automatically place the child in the high-risk category. Caesarean section also automatically places the child in the high-risk category. Valerie had none of these problems.

If Valerie had weighed less than 2500 grams, she would have been "at risk." Low birthweight infants can be divided into three categories: (1) infants of low birthweight who are prematurely delivered and have appropriate but low weight for their gestational age; (2) those who are of low birthweight and prematurely delivered but whose weight is even more inappropriately low for their gestational age; and (3) those of inappropriately low birthweight who are small or light for their actual full-term gestational age. All three types constitute an increased risk for handicapping conditions. With Valerie's weight of 3900 grams, she avoided all these categories.

Immediately after birth, Valerie was given Apgar scores of 7 at one minute and 9 at five minutes. These scores, which are a check of heart rate, respiratory effort, muscle tone, reflex irritability and color, fall into the "no risk" range for this infant and, therefore, do not add to her total "at risk" score. Infants who are moderately or severely depressed with Apgar scores below 5 may require respiratory assistance immediately after birth.

Once in the nursery, Valerie was scheduled for routine general, neurological, and laboratory examinations. The family history record disclosed that she had several normal siblings and her parents were not consanguinous. There were no retarded members of her family. Family history is important in infant assessment because there are many forms of central nervous system dysfunction which are hereditary. Most have an autosomal recessive genetic pattern. Consanguinity, of course, markedly increases the incidence of autosomal recessive disease entities.

NEONATAL MEASUREMENTS

The nursery examination should begin with a number of exact measurements of the baby. Length, weight. cranial circumference, chest circumference, and distance from the top of the head to the symphysis and from the symphysis to the heel (in order to determine the ratio of the upper to lower segment) are usually done. In addition to these standard measurements, the following three measurements are recommended:

1. Size of the anterior and posterior fontanelles (and sagittal suture or fontanelle, if large enough to be measured).
2. Inter-orbital distance measured from the center of one pupil to the center of the other.
3. Length of the auricle.

Many other measurements, such as the internipple distance and the total hand length, can be included if there is any indication of abnormalities by inspection.

Valerie had a length of 52 cm. and a weight of 3900 grams. These parameters are in the normal range for a full-term female. Her cranial circumference was 34 cm., 50th percentile for age (Nellhaus, 1968). Thus, the patient had neither macrocephaly nor microcephaly, both of which can be associated with central nervous system dysfunction. Her fontanelles and sutures were somewhat distorted by molding, but the sagittal was open and measurable at 3/4 cm. (Within a few days the effect of molding improves and sutures can be even more adequately measured.) Her anterior fontanelle was 4 x 4 cm. The posterior fontanelle was 1.5 x 1.5 cm. Both fontanelles were enlarged (Popich & Smith, 1972). There are many causes of enlarged fontanelles, including infant hypothyroidism, hydrocephalus, trisomy 21, and cleidocranial dysotosis.

Valerie's interpupillary distance was 4.9 cm., beyond the normal range for age, giving her a diagnosis of hypertelorism (Feingold & Bossert, 1974). Because of the hypertelorism, additional measurements were taken on Valerie's eyes. These included the inner canthal distance and the outer canthal distance (Feingold & Bossert, 1974) and palpebral fissure size (Smith, 1970). As there are a large number of retardation syndromes associated with hypertelorism (Table 2) and a small number with hypotelorism, this particular measurement is an important one in every newborn. Checking Valerie's examination with the table showed that she had hypertelorism plus prominence of the tongue, again raising the question of infant hypothyroidism or cretinism.

Valerie's auricle length was 3.4 cm., about the 50th percentile (Aase, Wilson, & Smith, 1973). There was no abnormality in shape or length so she avoided the problem of a small auricle which can suggest that there are shorter than usual lengths of the cochlear spirals in the inner ear of a child (Igarashi, Takahashi, Alford, & Johnson, 1977). The anatomy of the ear is important because difficulty with the processing of language in the early years of life can have cognitive consequences. For example, it has been recently demonstrated that children with chronic and severe otitis media, even if they are otherwise normal individuals, can manifest substantial delay in speech and language, have auditory processing defects, disturbances in auditory and visual integration, and are even more likely to have reading disorders and poor spelling skills than other children (Zinkus, Gottlieb, & Schapiro, 1978).

TABLE 2
HYPERTELORISM IN SELECTED AREAS

Chromosomal syndromes which may have hypertelorism	- 3p+, 4p-, 4p+, 5p-, 7q+, trisomy 8/bisomy 8 mixoploidy, trisomy 9p, trisomy 13, 13 deletion (13q-, 13r) syndrome, trisomy 18, 18 deletion (18q-, 18p- and 18r) syndromes, triploidy, XXXXY, XO
Plus upward slanting palpebral fissures	- Ehlers-Danlos syndromes - Papillon-Leage-Psaume - Oro-digito-facial syndrome - Some of the chromosomal syndromes
Plus downward slanting palpebral fissures	- Otopalatodigital syndrome - Treacher Collins mandibulofacial dysostosis - Gorlin-Chaudhry-Moss syndrome - Apert acrocephalosyndactyly syndrome
Plus epicanthic folds	- Some of the chromosomal syndromes - Elfin face syndrome - Ehlers-Danlos syndromes - Renofacial syndrome - Little nail-patella syndrome - Robinow-Silverman-Smith syndrome
Plus sparse eyelashes (hypotrichosis)	- Curtius ectodermal dysplasia with ocular malformations - Meyer-Schwickerath-Weyers
Plus congenital cataract	- Curtius ectodermal dysplasia with ocular malformations - Gansslen familial hemolytic icterus - Hallermann-Streiff - Ward's syndrome
Plus puckered mouth	- Freeman-Sheldon whistling face syndrome
Plus prominent tongue	- Infant hypothyroidism
Plus cleft lip-palate	- Piper - Bixler - Appelt-Roberts - McFarland syndrome - (palate only) Spranger
Plus congenital skin abnormalities	- Goltz focal dermal hypoplasia syndrome - Sjogren-Larsson oligophrenia - Ichthyosis-spastic diplegia syndrome
Plus "treefrog" toes	- Otopalatodigital syndrome

GENERAL EXAMINATION

Following measurements of the child, the general examination of the infant begins. This includes the child's cry, skin color, and amount of hair, as well as detailed examination of all parts of the body with special emphasis on the cranium and face. Transillumination of the skull, which can lead to the diagnosis of hydranencephaly or subdural hematoma, is a must in the newborn period. Cranial shape and configuration of the forehead should be noted. Regarding the face, every detail of the eyebrows, eyes, nose, mouth, jaw and neck could be of importance; for example, the synophrys of continuous eyebrows seen in the de Lange syndrome are the hallmark of diagnosis of that patient group. Every unusual aspect should be noted, including underdevelopment of the face in the maxillary area. When the infant cries, any facial asymmetry should be recorded.

Below the neck, any part of the general examination may be relative to central nervous system disease. There is an entire literature based on analysis of retardation syndromes using dermatoglyphics (abnormalities in the palm prints and foot prints). For the initial examination, brachymesophalangia V (small size of the middle phalanx of the fifth finger) is the single most common variation seen in retarded patients, but, like all mental retardation stigmata, can also be found in normal infants. Patients with chromosomal aberrations often have one or more organ systems, such as the cardiac, gastrointestinal, or genitourinary, affected by the disease process. Specific cardiac lesions can be associated with specific retardation syndromes--examples are supravalvular aortic stenosis of the elfin face syndrome and the valvular pulmonary stenosis of the Noonan syndrome. Examination of the musculo-skeletal system also is quite relevant.

In the case of our patient, a number of abnormalities were noted on general examination. Her temperature was slightly below normal and her skin was remarkable for its pallor and coldness and was very mottled the first couple of days of life. Her forehead was hirsuite and the tongue was visible most of the time. She appeared to have excessive fat at the back of the neck, and an umbilical hernia was present. She had a cardiac murmur and low voltage PRT waves.

NEUROLOGICAL EXAMINATION

Valerie's next examination was the more classical method of looking for abnormal brain function, such as the neurological examination of a full-term newborn infant designed by Prechtl (1977). Since even patients with severe brain damage syndromes can have relatively intact reflex and automation examinations in the first week of life, this classical examination, important as it is, is not adequate by itself. However, it gives a wealth of information which may be useful in detecting a retarded infant. Touwen, a colleague of Prechtl, did an evaluation of the items on the neurological examination and divided them into groups. His conclusion was that the items listed in Table 3 were the most useful in the neurological examination (Touwen, 1976).

TABLE 3
ITEMS REFLECTING THE INTEGRITY
OF BASIC NEURAL MECHANISMS (TOUWEN, 1976)

Group I

- Facial innervation
- Pupils
  - -shape
  - -reaction to light
- Optical blink
- Acoustical blink
- Reaction to sound
- Cremasteric reflex
- Muscle tone
  - -resistance against passive movements
  - -active power
  - -range of movements
- Head control
- Abdominal skin reflex
- Withdrawal reaction

Group II

- Spontaneous tremor
- Tremor during Moro reactions
- Conjugated eye movements
- Fixation time
- Visual pursuit movements
- Convergence of the eyes
- Pupillary reaction to convergence
- Corneal reflex
- Doll's eye phenomenon
- Rotation test
- Lip-tap reflex
- Recoil of the elbow
- Biceps reflex
- Ankle jerk
- Stepping movements

Prechtl has designed a short version of his neurological examination which is useful as a screening exam for every neonate. It should be stressed, however, that this screening test cannot replace a full neurological examination if a suspicion of neurological abnormality arises (Prechtl, 1977).

Valerie received the quick screening neurological examination. Several abnormalities were noted on the examination. Her sucking response was sluggish, her spontaneous motor activity was depressed, the resistance of both extremities to passive movements showed increased tone, and her head control was classified as poor. Because of these abnormalities on the screening exam, a full-term examination was performed. It confirmed the results of the earlier examination and provided the additional information that her skin temperature was low with vasomotor problems, that her reflexes were depressed, and that no pathological reflexes were present.

Valerie's examination led to the conclusion that central nervous system difficulty was possible, and she was transferred to a high-risk nursery. During her stay there, Valerie developed mild, apparently physiological jaundice which persisted for 10 days, an unusually long time. Also, she slowly became constipated. Although constipation can have many non-serious causes, in a newborn baby it is, in fact, associated with many of the more common forms of retardation, such as Down's syndrome and infant hypothyroidism. Therefore, it is one of the alerting signs for brain dysfunction in a young infant.

LABORATORY EXAMINATION

In the nursery, Valerie underwent a series of laboratory tests. Regarding laboratory evaluation of the newborn, there are a number of routine measures performed on newborn infants such as a study of hemoglobin, white cell counts, etc. In this study, Valerie was anemic.

METABOLIC/ETIOLOGICAL AND AUDITORY SCREENING

Equally routine, from the point of central nervous system dysfunction, should be two other screening procedures: (1) screening for metabolic correlates or etiologies of retardation, and (2) newborn screening for auditory dysfunction.

Issues

Regarding the importance of metabolic screening, the central nervous system in the newborn is especially vulnerable to a number of metabolic disturbances. Rat studies, whether using total cerebral DNA or myelin lipid or perinatal changes in brain weight, show that hypothyroidism, hyperphenylalaninemia, hypoglycemia and especially malnutrition affect each of these modalities adversely in the neonate (Chase, 1973; Chase, Marlow, Dabiere, & Welch, 1973; Chase & O'Brien, 1970; Walravens & Chase, 1969). The same principles may apply to human infants whose brains are exposed to such metabolic insults. Picked up on a metabolic screening procedure and adequately diagnosed, there are several diseases of the newborn that can be treated, virtually reversed and mental retardation prevented. However, if the disease is not diagnosed during the first month of life, institution of treatment at later ages does not prevent the retardation concomitant with the disease entity (Dobson, Williamson, Azen, & Koch, 1977; Klein, Meltzer, & Kenny, 1972). An absolute minimum of metabolic screening for all infants should include infant hypothyroid screening and phenylketonuria screening, which have already been shown to be cost effective even though these diseases occur at the incidence of one in 6,000 and one in 10,000, respectively (Levy, 1974). Once a laboratory is set up to do phenylketonuria, it is easy to add tests for the even rarer diseases of maple syrup urine disease, homocystinuria, and galactosemia. Screening for the organic acid diseases, which have established treatments and can be diagnosed by gas liquid chromatography-mass spectrometry systems, also should be part of a screening program.

In the past, the philosophy of screening has been to detect at birth only the diseases which had proven metabolic treatments. However, with the advent of infant intervention programs, a new consensus is emerging that all diseases associated with mental retardation should be detected early so that young children can be admitted to good stimulation programs. For such a detection program, a number of first stage screens may be useful for detecting babies at risk for retardation even if no specific metabolic treatment is available. These screens include IgM screening for neonatal infections (Mellits, 1971), whole blood serotonin which is abnormal in 22 forms of retardation (Coleman, 1978), and uric acid/creatinine ratio which is abnormal in one-fourth of all patients in institutions for the retarded.

Our patient, Valerie, had full neonatal screening and two abnormalities were detected. First, her T-4 level was found to be below the normal range and, after confirmation with further thyroid testing, a diagnosis of infant hypothyroidism was made. Also, her serotonin level was found to be above the normal range, a finding previously noted in infant hypothyroid patients (Coleman, 1970).

Regarding the importance of screening for auditory dysfunction, sophisticated instrumentation is now available to do adequate hearing screening of the newborn. In view of the importance of auditory processing to the development of cognitive functioning of the central nervous system, such screening should be instituted with all newborn children. Valerie passed her auditory test with flying colors.

SUMMARY

In conclusion, we have taken a newborn infant through the rudiments of an examination that should be performed routinely on every neonate. As a result of the clinical examination and biochemical screening, a diagnosis of infant hypothyroidism was made. Thyroid therapy was instituted by the time Valerie was two weeks of age, and she was also enrolled in an infant stimulation program. It is anticipated that Valerie's level of mental function has a significant chance to be within the normal range, in contrast to the severe retardation that would have occurred without such early diagnosis and treatment.

Valerie, her family, and her community will all benefit from this program of neonatal diagnosis of handicapped infants. It should exist everywhere.

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PRINCIPLES OF INFANT ASSESSMENT

Jennie E. Swanson

A number of issues need to be considered in relation to infant assessment. One involves a clear distinction between screening, diagnosis, and assessment. Screening has traditionally been primarily a "selective" procedure. Children are selected for further evaluation on the basis of their performance on a screening instrument. A child is judged to be functioning either adequately, in which case no further immediate evaluation is required, or inadequately, in which case a more detailed evaluation is indicated. Diagnosis is a more detailed evaluation and has traditionally resulted in categorical outcomes (e.g., mentally retarded, emotionally disturbed, etc.). Categorical statements may indicate a child's overall performance in relation to his or her age-mates (i.e., above average, average, below average) or it may indicate specific skill areas where a deficit exists (e.g., language, cognition, self-help, etc.). Assessment, on the other hand, is primarily a descriptive procedure. To assess, it is necessary to know what needs to be described and how to describe it, both of which relate to why the description is needed in the first place (e.g., for documentation, for programming).

Genetic studies have clearly documented the uniqueness of individual infants. Further, the development of an infant is a dynamic process involving the interaction of each infant and his or her environment. Maturational levels have an influence on behavioral development and environmental vulnerability (e.g., infants are vulnerable to different influences depending upon their level of maturation). One environmental influence which has received a considerable amount of attention is the parent. Parents are important as facilitators of their child's development. Interactions between a parent and a child are not unilateral in direction as was believed in the past (Brazelton, 1979). These interactions are considered by Sameroff and Chandler (1975) to be transactions which are cyclic or spiralling in nature. Each behavior in a dyadic transaction has the potential of influencing subsequent behaviors.

As a result of research, we've learned that there are a number of issues which need to be considered when assessing infants:

1. State variables. The state of an infant during assessment will exert a considerable influence on the child's perform-

ance. The younger the infant, the more important it is to take into account. Determination of an infant's state is crucial for meaningful neurological assessments. (Typical state descriptions include: alert and inactive, awake and active, crying, drowsy, deep sleep, irregular sleep.)

2. Cultural variables. An assessment which is not within the context of the experiences, language, and natural environment of the child is both unreliable and invalid.

3. Developmental milestones. Often in the past, the "tick-tock" of the normative clock has been imposed on the child's natural learning rhythms. We are now finding that there are often many paths to a particular milestone, as well as many variations in the rate of typical development. These findings point to the need for ongoing assessments over time as opposed to "one-shot" assessments.

4. Heterogeneity within diagnostic categories. The traditional diagnostic categories such as mental retardation, cerebral palsy, developmental delay, and motor delay do not provide information about an individual infant's characteristics and abilities. Within each diagnostic category there can be a fairly wide range of functioning. A quantitative and qualitative description of an infant's development is necessary as a basis for meaningful follow-up.

These are just a few of the issues related to infant assessment. I would like to discuss one issue in particular: the role of maturation in determining environmental vulnerability. There are a number of tools for assessing the maturation of young infants (e.g., Rosenblith & Graham, 1961; Prechtl & Beintema, 1964; Parmelee & Michaelis, 1971; Yang & Bell, 1975). The research of Dargassies is particularly applicable to the infant assessment area. Her work has involved a quantitative and qualitative inventory of neonatal neurology with consideration for normality, range of variance and changes over time. Dargassies (1977) has reported that infants mature in an innate pattern, independent of nutrition and pathologic aggression, until about 41 weeks postconception. She has delineated five criteria for maturation which are demonstrated by most newborns at term (40-41 weeks gestation): (1) flexed resting posture, (2) distribution of tonicity (brisk recoil of four limbs), (3) zero degree angle of foot dorsiflexion, (4) rooting reflex at four cardinal points, and (5) crossed extension reflex.

Infants with major symptoms of neurologic pathology who were assessed at their term-date exhibited abnormal vigilance (alertness), motility disorders, spontaneous ocular signs, body axis disorders, straightening disorders, and an abnormal cry. Another group of infants who were considered to be suspect at term also exhibited neurological abnormalities: poor quality vigilance, hyperexcitability, high-pitched cry, fanned toes, limited spontaneous motility, incomplete primary reflexes, and defective muscle tone in the neck and lower limbs.

According to Dargassies, the time to organize the environment in order to affect development is around the term date. From the time that the five criteria for maturation (see above) have been demonstrated by an infant, the environment impinges drastically. The point at which the five criteria are reached represents termness regardless of chronological age. It is clearly important for assessment tools to adjust for gestational or maturational age.

At this point, I would like to propose five principles for infant assessment and intervention:

Principle 1: Assess maturation and adjust for gestational age. It has been well documented that an infant's level of maturation is dependent upon gestational age rather than chronological age.

Principle 2: Implement assessment as an ongoing process. "One-shot" assessments resulting in a diagnosis do not provide a valid picture of an infant's development. To assess development, it is necessary to show the rate of development (which requires more than one assessment) in addition to the quality of the infant's performance. When an infant is placed in an intervention program, ongoing assessment is essential in helping the parents and staff make decisions about programming. Assessment over time is more valid than one-shot assessments: contexts change, moods vary, needs change, abilities change. Since parents are often a more consistent factor in an infant's life than are professionals, the parent becomes an obvious choice as the ongoing assessor.

Principle 3: Select assessment tools for their usefulness in planning meaningful intervention programs. Like assessment, intervention is a dynamic, ongoing process in which the infant and parents should be considered as active participants.

Principle 4: Identify the parents as the primary facilitators of the infant's development. Prior to 40-41 weeks gestational age, the parents' expectations, thoughts and feelings are important, but the extent of the infant's receptivity is not fully understood. The infant's early initiations seem to be based on internal biological needs: hunger, pain, discomfort, etc. The immediate responses to the infant's early initiations are assuming more and more importance as a foundation for later behaviors. For example, if the parent is responsive to the infant's crying in the early months, research has shown that the infant cries less at one year (Bell & Ainsworth, 1972). Bowlby (1969) views the infant's crying, smiling, sucking, and clinging as attachment behaviors which initiate or serve to maintain proximity between the mother and the infant. If early infant development is dependent upon responses to the infant's need-states or initiations, then the parent logically becomes the primary facilitator. This helps to explain the multitude of assessment instruments for parent-infant interactions which have been developed in recent years.

Assessment and intervention which look only at the infant's achievements (Gesell Developmental Schedule, the Merrill-Palmer Scale of Mental Tests, the Cattell Infant Intelligence Scale, the Griffiths Mental Development Scale, the Bayley Scales, etc.) or at the parents' competencies in isolation are missing a dynamic component of development, the transaction which occurs. A transaction is dynamic rather than static because the nature of a response in an interaction changes or influences the subsequent response. Interactions are not merely back and forth interchanges. Rather, they are spiralling or cyclic in nature and result in qualitative changes over time.

As we become more cognitively mature, we are able to be more adaptive. It appears that the target for early intervention, therefore, becomes the parent, not the infant. Beckwith and Cohen (1978) found that prediction of infant cognitive development correlated better with measures of the infant's social interactions with the parents than with neurophysiologic measures of the infant alone.

The functions of the mother, the father, siblings, and significant others need to be considered in interaction assessment. I would anticipate future assessments to include family dynamics. For instance, the father's relationship with the mother may affect the way the mother treats the infant (Parke, Power, Tinsley, & Hymel, 1979). In addition, the presence of a spouse seems to alter the interaction. Assessments of triadic dynamics as well as sibling and grandparent interactions are on the horizon.

Principle 5: Help parents develop competence as primary facilitators. Finally, parents need to be aware of the major developmental milestones or competencies required to function in our society. This implies the education of parents in child development and, particularly, their own child's development. At the same time, each family's values, needs, and rights must be respected. This implies the education of professionals in family education.

The quality or nature of our responses to young infants depends upon the unique characteristics of the infant. For example, if an infant is hypotonic or lethargic, he may need stimulation. If the infant is hyperexcitable or irritable, he may need to relax. For some infants, a relationship program, rather than a stimulation program would be indicated. Responding to the unique needs of the infant is important for a caregiver.

If parents are to be aware of their infant's level of functioning in order to provide appropriate experiences to "match" their infant's level of functioning, then assessment becomes a parental need. In order to provide appropriate experiences, they must first know where their infant is functioning or what their infant can do. Some areas of current interest in demonstrating to parents what their infant can do include locus of control or reciprocity, movement messages, sensory integration, skin signs, infant temperament, parent attitudes and perceptions, decrement of response to repeated stimuli, extended family impact, stranger anxiety, types of reactions, behavioral states, context and competency assessment, home environment studies, biorhythms, biofeedback, stress and nutritional effects, and analysis of the infant's cry.

Does assessment by parents bypass the professional? Not at all! The professional must identify the important areas to assess and make recommendations for appropriate experiences. The professional must be alert to new research findings which change the areas or items to be assessed and must communicate them in a practical and meaningful way to the parent. The professional may also be available to validate the parents' findings and to help the parents expand their repertoire of experiences with their infants.

Competency assessment is a means of assessing infants which incorporates these five principles. Competency assessment involves the integration of atypical and typical development. This framework is utilized by the Pre-Start Infant Project at Loyola University Stritch School of Medicine in Maywood, Illinois. Our focus is on developing parental competencies which, in turn, facilitate the child's competencies. Competencies are described to parents regardless of the level of functioning of their infant (Swanson, Bagnuolo, Coyer & Riccardi, 1979) and regardless of how premature or immature the infant is. You must know what a child can do in order to provide appropriate experiences.

The competency model we use encourages the parent to observe and record their infant's unique pattern of development over time. Parents use the book Partners in Child Development (Kise & Swanson, 1978), which has four parts: (1) recording the date and age of an observed competency of the child from birth to five years old; (2) plotting the child's unique developmental profile on a chart; (3) adapting and implementing suggestions for transactions; (4) creating new transactional opportunities based on the parent(s) observations and their child's functioning, and on the needs and interests of the child.

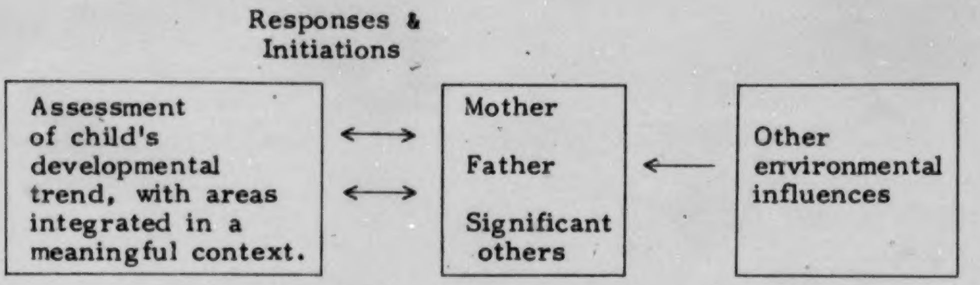
The intent of the assessment is to provide parents with a frame of reference for observation as a basis for providing more meaningful and caring interchanges with their infants. The parent does the assessment because he or she is generally the only consistent assessor through the years. Teachers may offer yearly assessment, but the parent has the potential for ongoing assessments year after year. This assessment over time is much more valid than a one-time assessment. The parent, then, becomes an important choice as the ongoing assessor in most cases.

If things the infant cannot do are reported to the parent, they often are immobilized. They do not have a direction. If, on the other hand, they are helped to see what their infant can do, they have a direction. They can either promote their child's present level of functioning or they can provide challenging and novel experiences related to their child's new interests, needs and past abilities.

Traditionally, children with special needs have been assessed by signs or conditions not yet present. I submit that every human being is competent and needs to be assessed on that value, whether the competency is simply the primitive withdrawal reflex present in an anecephalic infant, the spontaneous hand movement of a child with spina bifida, the smile of a child with cerebral palsy, the eye-blink reflex of a profoundly retarded youngster, the smile of a precocious newborn, or the early language of a toddler.

This shift of value from deviant functioning to competency functioning has the potential of positively influencing the major transactor(s) in the child's life experience, the parent(s). What we value, we tend to assess. What we assess, we tend to facilitate. What we facilitate, we very often value. I would like to suggest a new schema for assessment: a new value (see Figure 1).

FIGURE 1
TRANSACTIONAL ASSESSMENT


Responses & Initiations
Assessment of child's developmental trend, with areas integrated in a meaningful context.
Mother
Father
Significant others
Other environmental influences

Awareness of functioning as well as process.
Qualitative and quantitative assessment.
A moment of time captured.
Ongoing assessment needed for reliability.

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FOCUS ON THE PARENT-INFANT DYAD

Jean Kelly

Many research studies in recent years have focused on the importance of the relationship between the primary caregiver and the infant. Kagan (1966) maintained that the absence of a regular caregiver leads the child to withdraw from the social environment. He regards the first 18 months of life as critical for later psychological development.

Yarrow, Rubenstein, and Pederson (1975) undertook a detailed examination of the infant's environment. They studied the impact of early infant experiences by describing the environment of young infants and then relating the animate and inanimate dimensions of that environment to the infant's social, cognitive, motor, and motivational characteristics. They emphasized the importance of looking at refined categories of infant signals and maternal responses, yielding a richer picture of the complex network of social exchanges.

Barnard and Eyres (1977) reported the first-year results of a longitudinal study designed to assess infant and early childhood care systems accurately, in order to allow for appropriate preventative activities when possible. They include in their extensive investigation assessments of infant characteristics, maternal characteristics, and mother-infant interaction. They developed a teaching and feeding scale to assess the evolving reciprocal patterns of the pair. Their analysis of data on 177 mother-infant pairs indicated, among other things, that at every age, the factors that most clearly distinguish families from one another are those that reflect the quality of mother-infant interaction.

INTERACTION BEHAVIORS

Interaction can be defined as reciprocal action involving two or more people. In order to interact, at least two persons must communicate by exchanging some kind of feeling or idea. Rieke (1974) specified communication behaviors as either initiating or responding behaviors. She defined initiating behaviors as those verbal or nonverbal behaviors by which one gains the attention of another. Responding communication behaviors, she stated, are those that respond to a preceding action or event.

Various studies point to the interplay between initiating and responding behaviors in the parent-infant dyad. As early as 1959, Chess, Thomas and Birch hypothesized that various child care practices were determined not only by what the mother feels and does but also by the specific pattern of behavioral responses that characterizes the individual child. Korner (1971) stated that individual infant differences at birth may affect later development, including the manner in which different infants will perceive the world around them. She suggested that for mutuality to develop between the mother and child, individual infant behaviors must evoke differences in mothering. In summarizing her own research and that of others, she reported that certain individual characteristics of the newborn will affect short and long-range adaptation to the environment, and that parents should tune in to the infant and deal with his/her behavior differentially.

Brazelton, Koslowski, and Main (1974) discussed a method for assessing the effective communication system that develops between infants and their caregivers within the first few months of life. They videotaped caregiver and infant behaviors simultaneously and reported that rhythmicity between the primary caregiver and the infant is an essential characteristic of the developing relationship. That is, there seems to be a positive interaction when each member of the dyad is responding to the needs of the other member. When one member is out of phase with the other, there seems to be a negative quality about the interaction. The strength of the interdependency of the dyad seemed to be more powerful in shaping each member's behavior than did any other factor.

Thoman (1975) reported on the mother-infant adaptation process. Each baby, Thoman concluded, has his own capabilities for providing cues to the mother, and each mother has unique ways of responding to her baby. Thoman described the process of adaptation as a behavior pattern developed in a three-part cue-response sequence: (1) cue-giving by the baby, (2) cue-responsiveness of the mother, and (3) the response of the baby to the mother's action.

Moss (1967) studied 30 mother-infant pairs over the first three months of the infant's life. He proposed that maternal behavior initially tends to be under the control of the stimulus and reinforcing conditions provided by the young infant. As the infant gets older, the mother, if she behaves contingently towards the infant's signals, gradually acquires reinforcement value, which in turn increases her ability to regulate infant behaviors. The point at which the infant's control over the mother declines and the mother's reinforcement value emerges could be regarded as the first manifestation of socialization.

The above studies researched several mother and infant behaviors that characterize interaction. Other investigations have examined one or just a few specific behaviors and their consequences. Bell and Ainsworth (1972) studied infant crying and maternal responsiveness in 26 mother-infant pairs during the first year of life. They reported that crying is one manifestation of an emergent communication system, and maternal responsiveness to crying fosters the development of communication and encourages the later development of means-ends abilities. Rubenstein (1967) assessed exploratory behavior at 6½ months as a function of different levels of stimulation at 5 months. Infants who received high amounts of maternal attention at 5 months performed significantly better on exploratory behavior tests at 6½ months than infants who received less attention.

Lewis and Goldberg (1969) found that there is a positive correlation between maternal responsiveness to infant behavior and the cognitive development of the infant at three months of age. They suggested that the mother's acquisition of reinforcement value is one indication that the infant has learned to expect environmental pay-off, and this is the basis for future learning. Stern (1974) examined mother and infant gaze behavior during a play situation. Eighteen infants and their mothers were observed from the third to the fourth month of life. Stern found that although mothers were more likely to initiate gaze, infants usually made or broke the gaze. He emphasized that there is an optimal level of maternal stimulation for each infant, beyond which the infant loses interest.

It may be concluded that infants initiate and respond in unique ways, which in turn evoke responses from the caregiver, which lead to further infant responses. This early communication system is crucial to the later skill development of the infant.

EFFECT OF POSITIVE AND NEGATIVE FEEDBACK

As previously stated, Brazelton et al. (1974) emphasized the need for a balanced, mutually satisfying social relationship between the infant and the caregiver. The quality of the interaction depends not only on the frequency of communication behaviors, but also on the effect the communication has on the other member of the dyad.

This leads to a second dimension in analyzing interaction behaviors: the effect of positive and negative messages on the interaction.

Stern (1971) analyzed the behavior-regulating social contact between a mother and her 3½-month-old twins. A portable TV recorded all activity between the mother and infants during three consecutive morning hours in the home, over a period from the time the infants were 3½ months old until they were 15 months old. The results showed that although the mother and one of her infants generally spent more time interacting, the interactions were mutually unsatisfying. The mother and her other infant spent less time together, but seemed to enjoy each other more. At 15 months, the infant who had engaged in negative interactions with his mother appeared fearful, refused prolonged eye contact, and made extreme face aversions in social situations.

Beckwith (1972) observed 24 mother-infant pairs during the second six months of the infants' lives. She reported that the more suppressive and critical a mother was, the less responsive the infant was in social play with the mother. She concluded that the amount of time the mother spent with the baby was not as important as the quality of time spent.

Yarrow, Rubenstein, and Pederson (1975) reported that high levels of maternal positive affect serve to maintain the infant in an optimal state of arousal and thus increase his responsiveness to people, sustain his attention to the environment, and support his active attempts to explore and obtain feedback from objects. They also reported on the effect of a number of specific mother and infant positive behaviors in establishing reciprocal and mutually satisfying interactions.

Studies have related punishing, critical, or directing caregiver behavior to poor infant performance on infant scales (Ainsworth & Bell, 1975), on intelligence tests given later in life (Bayley & Schaefer, 1964) and in language acquisition (Nelson, 1973). These few studies demonstrate that positive and negative interactions between caregivers and infants critically influence the later skill development of the infant.

INTERACTION WITH A HANDICAPPED INFANT

Researchers have studied how parents are affected when they have a handicapped infant. Olshansky (1962) refers to the common

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parental reaction to the birth of a mentally retarded child as "chronic sorrow," which suggests the need for continual adjustment. Drotar, Bashiewicz, Irvin, Kennell, and Klaus (1975) analyzed interviews with 20 parents to determine the course of parental reactions to the birth of a child with congenital malformations. They identified five steps of parental reaction: shock, denial, sadness and anger, adaptation, and reorganization. Klaus and Fanaroff (1973) cautioned doctors to anticipate maternal mourning for the loss of the perfect infant the mother had expected. He suggested that these feelings could interfere with the parents' ability to initially accept the child fully.

Goldberg (1977) is currently involved in a project designed to assess the impact of neonatal problems and resulting differences in infant behavior on the development of parent-child interaction. Four groups of infants are being studied: normal full-term, healthy premature, sick premature, and infants of diabetic mothers. Preliminary findings suggest that the sicker the infant has been, the poorer it scores on several newborn measures, and at the first two feedings, the sicker the baby, the less he is cuddled and talked to.

Robson and Moss (1970) suggested that the release of human maternal feelings depends heavily on the infant's capacity to exhibit behavior that characterizes adult forms of social communication. They studied 54 mothers and their infants during the first three months after birth, and found that mothers who were late attachers or who did not attach at all either did not want infants or had babies with deviant behavior. This research suggests the hypothesis that delayed infants exhibit less social behavior and, therefore, do not as readily encourage maternal attachment.

Several studies have attempted to isolate differences in the interaction when the infant is handicapped by comparing groups of handicapped infants and their caregivers with nonhandicapped infant-caregiver pairs. Marshall, Hogrenes, and Goldstein (1973) studied 20 mentally retarded children and their mothers and 20 nonretarded children and their mothers. They contrasted the two groups on the frequency of four types of verbalizations and found that the mentally retarded infants verbalized less frequently. Mothers of retarded children had a higher frequency of demanding, commanding, requesting, and asking behavior. Thoman, Becker, and Freese (1976) assessed interaction between 20 infants and their mothers. Three of the infants were later diagnosed as delayed. She compared these three infants and their mothers with the total group and discovered, among other things, that all three mother-infant pairs had markedly less social interaction than the rest of the group.

Vietze, Abernathy, Ashe, and Stitch (1978) compared a group of developmentally-delayed infants and their mothers with a group of nondelayed infants and their mothers on vocal behaviors. In addition, they divided the developmentally delayed infants into two groups, one group having scored higher on the Bayley Scales than the other. In all groups, mothers tended to dominate dialogues at all ages. Results for the delayed and nondelayed groups at one year of age were strikingly similar; both groups showed a great deal of reciprocal vocal interaction. With the two groups of developmentally delayed infants, however, the failure of the lower scoring group to differentiate between presence and absence of maternal vocalizations eventually affected the interactive style of the mothers. The authors maintained that this failure may lead to the mothers responding less contingently.

Tyler, Kogan, and Turner (1974) reported on the results of a two-year study of interpersonal experiences among ten cerebral palsy children, their mothers, and their therapists. Verbal and physical interactions were recorded and analyzed at 10-month intervals. Both mothers and children displayed greater amounts of negative affect during therapy sessions than during play sessions, and their simultaneous efforts to compete for control of the situation suggested that the new experience was highly stressful. At the end of two years, therapy situations were still characterized by greater amounts of negative affect than in play sessions. Although mothers were more negative, they were not correspondingly less positive in therapy than in play. Mothers' displays of positive affect decreased significantly in all situations over time, and at the end of the study, mothers were displaying significantly less warmth than groups of comparison mothers.

These research efforts show that the caregiver-infant interaction is complicated when the infant is handicapped. It is necessary to continue to explore interaction involving handicapped infants in order to structure the most useful educational and social experiences for these infants and their caregivers.

ASSESSMENT INSTRUMENTS USED WITH CAREGIVERS

The following information on assessment instruments can be found in an excellent book by Erickson (1976).

BRAZELTON NEONATAL BEHAVIORAL ASSESSMENT SCALE

Brazelton began work in the 1950s on an instrument to assess neonatal behavior. He was convinced that the neonate shapes his environment as much as or more than the environment shapes him. The tool he developed, the Neonatal Behavioral Assessment Scale, has emerged as the best means yet of assessing the subtler behavioral responses of the newborn as he adjusts to and shapes his environment. The scale measures a total of 27 behavioral responses of the infant. The items are repeated several times so that the infant is rated on his best performance. Each of the 27 items is rated on a 9-point scale corresponding to nine choices given for each item. The scale also includes 20 elicited reflexes and movements measured on a 3-point scale. The exam takes 20 to 30 minutes. Scoring may take from 10 to 15 minutes. Erickson (1976) organized the 27 behavioral items into six categories:

1. Habituation. How soon the infant diminishes responses to stimuli of light, sound, and a pinprick to the heel.
2. Orientation. Auditory and visual items are presented to determine how much and when the infant attends to, focuses on, and gives feedback in response to stimuli.
3. Motor Maturity. The degree of the infant's motor coordination and control throughout the exam.
4. Variation. Infant's rate and amount of change during periods of alertness, and his states, color, activity, and peaks of excitement throughout the exam.
5. Self-quieting Abilities. How consolable is the baby?
6. Social Behaviors. Smiling and cuddling behaviors.

The instrument has two main purposes. First, it can be used to discriminate between abnormal and normal infants. Second, it can be used to help caregivers recognize the variety of ways an infant can affect and interact with the environment. Parents can observe their infant's unique temperament and behavioral patterns. These observations can help parents decide the best ways to meet their individual infant's needs. The scale can assist parents in the early acquaintance process with their infant. Parents can observe the importance of state, position, touch, voice, etc., and see themselves as significant resources for their baby from the very beginning.

BROUSSARD NEONATAL PERCEPTION INVENTORY

Broussard and Hartner (1971) carried out a longitudinal study on maternal perceptions of firstborn children. They found that the critical variable associated with the need for later intervention for a child appeared to be the mother's perception of her infant at one month of age.

The Neonatal Perception Inventory consists of an "Average Baby" form and a "Your Baby" form. Both forms are administered at one or two days postpartum and again at one month. In addition, at one month the mother is asked to complete a "Degree of Bother" inventory. These forms reflect the mother's perceptions of these behaviors: crying, spitting up or vomiting, sleeping, feeding, elimination, predictability of eating and sleeping patterns. The infant is considered to be at low risk if the mother rates the infant as better than the average baby. Those infants not rated better than average are at risk for subsequent development of emotional difficulty. The instrument can be used to identify infants who will need surveillance in regard to parent-child interactions. It may also indicate the necessity of beginning preventive intervention with parents so that healthy interactions are possible between infant and mother.

CAREY INFANT TEMPERAMENT QUESTIONNAIRE

Carey, a pediatrician, was interested in knowing the effect an infant's temperament has on his present management and future development. He defines temperament as the emotional reactivity or behavioral style that is displayed by an infant in the early months of life.

The Carey questionnaire is used to detect the temperament of an infant between four and eight months of age. It consists of 85 statements to be answered by the mother. Each statement has three choices from which the mother selects the best description of her infant's behavior. The completed questionnaire is rated according to each of nine categories of temperament: activity, rhythmicity, adaptability, approach, threshold, intensity, mood, distractibility, and persistence. The following is an example of an "approach" behavior:

Initial reaction to approach by strangers
- a. positive, friendly
- b. variable reaction
- c. initial withdrawal

The principal uses of the questionnaire are: (1) to serve as a basis for general discussion of an infant's temperament; (2) to serve as a basis for discussing an individual infant's needs; (3) to help with clinical problems of which infant temperament can be a part. Feedback from the questionnaire should be given to parents. Carey points out that it is important for mothers to gain a more objective view of infant temperament and behaviors so that more effective counseling, support, advice, and reassurance can be offered to those who indicate concerns about interacting with and caring for their infant's needs.

HOME OBSERVATION FOR MEASUREMENT OF ENVIRONMENT

Caldwell has been doing research for many years to develop hypotheses about the nature of the environment and how it best meets the needs of children. Based on clinical observations and observations in the home, an inventory was developed that was intended to assess the environmental characteristics of a child from birth to three years of age that affect developmental outcomes for the child. The instrument is called the Home Observation for Measurement of the Environment (HOME). The inventory measures the following six aspects of the environment: (1) emotional and verbal responsivity of the mother, (2) avoidance of restriction and punishment, (3) organization of the physical and temporal environment, (4) provision of appropriate play materials, (5) maternal involvement with the child, and (6) opportunities for variety in daily stimulation.

The tool is a means of providing feedback to parents about the way they regulate their child's environment and how to make environmental changes that best encourage growth and development. When interpreting the results it is always best to emphasize the positive aspects of the interaction, then discuss possible changes in the environment. Parents should first discuss their concerns and perceptions of the environment. Then the interventionist can make suggestions. In this way the HOME can foster more appropriate interactions between parents and children. It can be used to reinforce parents in their efforts and to make suggestions for appropriate learning experiences.

PARENT INVOLVEMENT IN INFANT INTERVENTION PROGRAMS

In a recent review of several early intervention efforts, Bronfenbrenner (1975) reported that intervention is most effective when the program is home-based, begun when the child is very young, involves the parent directly in activities fostering the child's development, and encourages reciprocal interaction between the mother and child. Several programs for disadvantaged high-risk infants and their parents have recognized parent education and improvement of parent-infant interaction as major program goals (Gordon, 1969; Heber & Garber, 1975; Lally & Honig, 1975; Ramey, Collier, Sparling, Loda, Campbell, Ingram, & Finkelstein, 1976; Weikart, Lambie, Wozniak, Miller, Hull, & Jeffs, 1969). Examples of programs for handicapped infants that have specific goals to include parents are Shearer and Shearer's (1976) Portage Project, Haynes' (1976) National Collaborative Infant Project, Bricker and Bricker's (1976) Infant Intervention Project, and Hayden and Haring's (1976) Model Preschool Center for Handicapped Children.

Bromwich (1976), at the Infant Studies Project at UCLA, uses an approach that is significant because it specifically designs intervention around the level of parent-infant interaction. She outlined a 6-stage maternal progression that moves from "mother enjoys being with her infant" to "mother independently generates a wide range of developmentally appropriate activities and experiences." After assessing the mother's level of functioning, immediate intervention goals are developed with respect to maternal behavior.

The importance of parent involvement in intervention is generally accepted. It is encouraging that researchers working with the handicapped are looking at techniques to facilitate healthy parent-child interactions. There remains a great need, however, to develop detailed observational systems for assessing the interaction of handicapped infants and caregivers, and then to design intervention programs to meet individual needs.

ASSESSMENT AREAS FOR INDIVIDUALIZED PROGRAM GOALS

For the past two years, I have been very interested in developing ways of assessing parents' needs and parent-infant interaction when the infant is handicapped. To determine individualized goals including parents, we must have a way of assessing individual needs.

There are many factors influencing parent-infant interaction when the infant is handicapped. I have grouped these factors into four categories: caregiver's adjustment process, caregiver's support system, caregiver's behaviors during the interaction, and infant's behaviors during the interaction. The following checklist outlines factors in the first two categories, caregiver's adjustment process and support system, that could be considered in designing intervention programs. The other two categories, caregiver and infant behaviors, can be assessed using an observational system which I will discuss later.

Factors That May Influence the Caregiver and Handicapped Infant Attachment Process

Caregiver's Adjustment Process

1.	Is able to discuss initial diagnosis?	No	Somewhat	Yes
2.	Realistically discusses child's developmental level?	No	Somewhat	Yes
3.	Relates an understanding of the handicapping condition?	No	Somewhat	Yes
4.	Has read literature and/or talked to professionals about child's handicap?	No	Somewhat	Yes
5.	Asks questions about different aspects of child's condition?	No	Somewhat	Yes
6.	Discusses child's future?	No	Somewhat	Yes
7.	Asks questions about how to promote development in specific problem areas?	No	Somewhat	Yes
8.	Is anxious to become involved in an intervention program and/or plan intervention techniques for use at home?	No	Somewhat	Yes
9.	Seems to accept own feelings about having a handicapped child?	No	Somewhat	Yes
10.	Includes child in family activities such as meals, outings, etc.?	No	Somewhat	Yes

Caregiver's Support System

1.	Feels partner has accepted child's handicapping condition? (If there is no partner in home, check No.)	No	Somewhat	Yes
2.	Feels partner is supportive of decisions made at home?	No	Somewhat	Yes

3.	Feels other children have accepted child's handicapping condition?	No	Somewhat	Yes
4.	Feels family can discuss child's handicap?	No	Somewhat	Yes
5.	Role descriptions seem to be clearly defined in family?	No	Somewhat	Yes
6.	Family seems to have similar goals and plans for achieving goals?	No	Somewhat	Yes
7.	Has supportive extended family living in the area?	No	Somewhat	Yes
8.	Has supportive friends living in the area?	No	Somewhat	Yes
9.	Feels professional help is adequate at present?	No	Somewhat	Yes
10.	Feels support system is adequate to provide for own personal fulfillment?	No	Somewhat	Yes

OBSERVATIONAL SYSTEMS USED TO ASSESS CAREGIVER-INFANT INTERACTION

If the interaction between an infant and the parent appears to be at risk, then the interventionist needs to gather specific assessment data to determine how to facilitate a better interaction pattern. A very effective way to gather this information is by observing the parent and the infant as they interact. Several researchers have developed systems or schedules to observe parent-infant behaviors during interaction. I will talk briefly about three of these schedules as they were described in a lengthy article by Coller (1972). If you are interested in these or additional schedules, the Coller article is a good source.

MOTHER-CHILD INTERACTION SCALE

The Mother-Child Interaction Scale (Apfel, Barnett, Kearse, & Watts, 1970) is composed of five subscales: (1) developmental concern, (2) who initiates the interaction, (3) mother's encouraging or discouraging behaviors, (4) mother's interactive techniques, and (5) the success of the mother's attempt to influence the child's behavior. The scale has been used to assess mother-child interaction of 1- to 2-year-olds and 2- to 3-year-olds. Essentially, the scale is designed to distinguish the form from the content of the mother's behavior. Four observer pairs took part in the reliability study. Five methods of computing the concerns subscale were used. Overall agreements were in the upper .70s.

Sample Item--Developmental Concern: (1) cognitive: verbal learning; (2) cognitive: perceptual, fine motor learning; (3) social behavior, positive; (4) social behavior, negative; (5) health, basic care; (6) enjoyment-mastery exploration: gaining information from physical environment; (7) enjoyment-mastery exploration: gaining information from play, toys; (8) imagination; (9) affection; (10) practical household skills; (11) gross motor learning; and (12) purposelessness.

ISIS RECIPROCAL CATEGORY SYSTEM

On the ISIS Reciprocal Category System instrument (Gordon & Jester, 1970), behavior is coded into one of twelve categories related to interactive behavior: warms, accepts, amplifies, elicits, responds, initiates, directs, corrects, cools, silence, confusion, infant sleeping. The system was used in an infant study (N=200) to code three-way interactions between a trainer, a parent, and the infant. The mother or trainer was assigned a simple task to teach to her infant. The instrument was useful for assessing trainer-mother behaviors, then mother-child interactions. No psychometric description was reported.

Sample Item--Warms: baby smiles, laughs, gurgles, coos, etc. (including self-reinforcing behavior).

MOTHER-CHILD INTERACTION CODING SCHEMA

The Mother-Child Interaction Coding Schema (Bronson, 1972) assesses signalling behavior in the child and mother's response to such behavior. The instrument is designed to code mother-child interactive themes, but not the length of particular types of interactions. The focus is on who does what to whom under what circumstances. Thus, the coding system requires the child's signal pattern and the context within which it occurred to be specified. The organization of maternal behaviors within the coding system focuses on the major functions which the mother serves vis-a-vis her baby: controlling, teaching-informing, shaping, caretaking, and socializing. The coding system is divided into six major sections: time/distance, child's signal to mother, context referent, mother's behavior to child, child's behavior to mother, and mother's language. No psychometric description was provided.

Sample Item--Baby's signal to mother: coding involves a simple classification of baby's behavior (e.g., presence of regard, vocalizations, words, movements toward, and specific action patterns directed to mother). Mother's control: accedes, controls-denies, controls-prohibits, and intervenes physically.

PROPOSED OBSERVATIONAL SCHEDULE

For my doctoral dissertation on the interaction of parents and handicapped infants, I have developed an observational schedule (Kelly, 1978) for primary caregiver-infant interaction during a teaching task. The instrument is designed to assess caregiver-infant behaviors during a 10-minute teaching session. Two categories of behaviors are measured: initiating and responding. These behaviors will also be rated as being either positive or negative. An additional rating of controlling behaviors (e.g., directions, commands, questions, models) will be included for caregiver categories. A guide to caregiver and infant behavior is included in the observational schedule. The teaching session will be videotaped for later coding. We are currently gathering reliability data on the schedule, which is still under development. An example of a behavior that could be coded as "caregiver-responding-positive" is caregiver's response to an infant coo with a smile.

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DEVELOPMENTAL SCREENING OVERVIEW

John H. Meier

It is widely believed that the earlier an incipient developmental disability (DD) is identified, the better. Of course, in the case of any condition which is accompanied by pain or mental anguish on the part of a child and/or his family, it should be stopped as soon as possible. When a given set of circumstances are such that, if a child is left untreated with a high probability of various DDs, the proper and humane thing is somehow to intervene and either improve the circumstances or remove the child from them. These preceding situations contributing to DD-incidence are relatively straightforward and, from the standpoint of proper and humane management, are relatively simple to resolve. Generally speaking, the earlier these potential or full-blown DD conditions are detected, the less likely they are to become severely disabling. Therefore, the argument for early screening and assessment of children at risk for DDs is upheld.

On the other hand, there are some DDs which cannot be dealt with effectively even when they are detected early, and others which cannot be detected any earlier than they are now being routinely identified within the current state of the art. Moreover, screening and assessment procedures themselves are typically designed to find problems and, in order to be certain that no minimal problems go undetected, some children are falsely identified as being at risk for a given DD when in fact they are not. This leads to the horrendous disservice of prematurely or inaccurately labeling a child and subsequently looking for and perhaps even creating problems that did not previously exist.

All DDs do not have their origins within the individual, and any genuine attempt to fully account for the many factors which might be contributing to a DD condition would have to take into consideration numerous possibilities. Table 1 breaks these origins into two main categories, those occurring within the individual (intra-individual) and those occurring as a result of factors outside of the individual (inter-individual/extra-individual). These categories are then divided into several subheadings. Space restrictions preclude discussing these subheadings here, but such elaboration is available elsewhere (Meier, 1976). The most important understanding to be derived from this introductory outline of the origins of DDs is that by no means are all DDs to be construed as

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TABLE 1
ORIGINS OF DEVELOPMENTAL AND LEARNING DISABILITIES

- I. Intra-individual
  - A. Physical--neuro-sensorimotor
    - 1. Neurological immaturity
    - 2. CNS damage or dysfunction
    - 3. Sensory defects
    - 4. Motor deficiencies
  - B. Social--linguistic/interactional
    - 1. Language disorders
    - 2. Defective adaptive behavior
  - C. Emotional--affective/attitudinal
    - 1. Emotional disturbance
    - 2. Motivational deficiencies
  - D. Intellectual--cognitive/perceptual
    - 1. Specific learning disabilities
    - 2. General mental deficiency
- II. Inter-individual/extra-individual
  - A. Ecological--natural interpersonal/environmental
    - 1. Experimental)
    - 2. Parental)
    - 3. Social) Deprivation or distortion
    - 4. Language)
  - B. Inflicted/non-accidental
    - 1. Physical)
    - 2. Emotional)
    - 3. Sexual) Abuse and/or neglect
    - 4. Medical/nutritional)
    - 5. Educational)

originating within an individual learner. DDs may and frequently do originate outside of the individual and may be caused by factors over which the individual has little or no control. It is even more typical for there to be an intra-individual predisposition to DD, which is evoked or at least exacerbated by extra-individual and inter-individual factors.

There has traditionally been an inclination to seek, and sometimes at all costs to find, some organic explanation for a DD within the individual without carefully analyzing the many extra-individual and inter-individual factors contributing to or causing the DD. The state of the art regarding the origins of DD still largely reflects this predilection to place the blame for various DDs exclusively within the individual child. As more is learned about the importance of the ecological factors surrounding the individual, either facilitating or debilitating his development, the balance of culprits indicted for causing DDs may shift remarkably in the direction of inter- and extra-individual dimensions, with consequently different alternatives to intervention being advanced (Rappaport, Davidson, Wilson, & Mitchell, 1975).

EARLY DETECTION AND ASSESSMENT OF DD

This section is drawn from a much more extensive monograph (Meier, 1973) which addresses operational or proposed methods and materials for the early developmental screening and assessment of young children. Table 2 presents extant techniques and instruments for the early (albeit largely intra-individual) assessment of those who have various DDs or are at considerable risk of later developing them. It lists a representative sample of tests and procedures for identifying, evaluating, and classifying the developmental status of young children.

To categorize neatly and consistently everything germane to the aforementioned is virtually an impossible task. Nevertheless, this section attempts to establish at least a point of departure for a subsequent, more comprehensive and detailed endeavor. In order to stay within the focus of this chapter, discussion of the following considerations has been omitted and would be conspicuously absent from any complete and balanced presentation: (1) federal mandates for early and periodic screening, diagnosis and treatment (EPSDT) of DDs; (2) definition(s) of DDs; (3) controversial issues regarding at-risk registers and populations; and (4) some of the broader societal, ethnic, ethical, and legal considerations relative to any massive identification/intervention programs, although recommendations at the end of this chapter address some of these pros and cons.

Significant advances have been made beyond both the Procrustean notion of making all individuals fit a predetermined ideal human mold and the ancient Spartan method of gross screening

TABLE 2
SELECTED DEVELOPMENTAL SCREENING TESTS AND PROCEDURES FOR CHILDREN UNDER THREE

Test or Procedure	Developer or Author	Age(1)	R(2)	V(3)	Time(4)	C/C(5)	Adm.(6)
PHYSICAL							
Biochemistry & Cytogenetics	Guthrie	B-3 mo.	A	A	U	<1	LT, EE
Amniocentesis	O'Brien	C-B	A	A	60	20	P
Metabolic	Howell, Holtzman & Thomas	B-3 mo.	A	A	<30	2	LT, EE
Ultra-Micro Automated System	Ambrose	B-3 mo.	A	A	60	1	Mix
Nutritional Status	Fomon	B-30 mo.	A	U	20	1	PP
Gestational Age	Lubchenco	B-1 mo.	A	A	5	2	PP
Statistical Mortality Morbidity	MCH	B-12 mo.	A	A	Neg	Neg	P
Statistical Epidemiology	Tarjan, et al.	Pre-B	A	A	Neg	Neg	P
Data System	Scurletis, et al.	Pre-B	A	A	Neg	Neg	PP
Prevention	de la Cruz & LaVeck	Pre-C	U	U	U	U	P
Apgar Rating	Apgar	B	A	A	6	1	P
Vision	Press & Austin	>30 mo.	U	U	Neg	1	PP
Eye Screening	Barker & Hayes	B-5 yr.	U	U	Neg	>1	PP
Electro-Oculograph	Petre-Quadens	1-6 yr.	A	U	120	10	LT, EE
Hearing High-Risk Register	Hardy	C-3 yr.	A	U	Neg	Neg	PP
Hearing Screening	Young; Downs & Silver	9-12 mo.	A	A	5	2	PP
Potential Battered Children	Kempe & Helfer; Gil; Walworth & Metz	C-2 yr.	U	U	U	U	P
Vocalization Analysis	Fillippi & Rousey	B-12 mo.	U	U	40	20	PP
Behavioral & Neurological Assessment Scale (I)	Brazelton	B-3 yr.	A	U	40	30	P
INTELLECTUAL/COGNITIVE							
Attention to Discrepancy	Kagan	B-12 mo.	A	U	30	20	LT, EE
Ordinal Scales of Cognitive Dev.	Uzgiris & Hunt	B-3 yr.	U	U	60	30	PP
Infant Intelligence Scale (CIIS)	Cattell	B-30 mo.	A	A	25	15	P
Bayley Scale of Infant Dev.	Bayley	B-30 mo.	A	A	45	25	P
Kuhlmann-Binet Infant Scale	Kuhlmann	B-30 mo.	A	A	30	15	P
Griffiths Mental Dev. Scale	Griffiths	B-4 yr.	A	A	30	15	P
Gesell Developmental Scale (Revised Yale)	Gesell, et al.	B-5 yr.	A	A	40	30	P
Ivanov-Smolensky	Luria	B-24 mo.	A	U	20	15	LT
Habituation	Lewis, et al.	B-18 mo.	A	A	30	15	PP
Psychophysiological	Crowell	B-3 mo.	A	A	80	50	Mix

LANGUAGE							
Playtest	Friedlander	3-12 mo.	A	A	50	25	LT, EE
Infant Cry Analysis	Ostwald, et al.	B-3 mo.	A	U	30	15	LT, EE
Expressive Language	Reyes, et al.	2-4 yr.	A	A	40	20	PP
Receptive Language	Marmor	1-3 yr.	A	U	30	15	PP
Early Language Assmt. Scale	Honig & Caldwell	3-48 mo.	A	U	30	15	PP
SOCIAL/EMOTIONAL							
Behavioral & Neurological Assessment Scale (II)	Brazelton, et al.	B-3 yr.	A	U	30	15	PP
Behavior Problem Checklist	Quay & Peterson	B-4 yr.	U	U	30	20	P
Rimland Diagnostic Checklist	Albert & Davis	B-4 yr.	U	U	30	20	P
Quantitative Analysis of Tasks	White & Kaban	1-6 yr.	A	A	60	30	PP
Behavior Management Observation Scales	Terdal, et al.	B-4 yr.	U	U	60	20	PP
Vineland Soc. Maturity Scale	Doll	B-18 yr.	A	A	25	10	PP
Preschool Attainment Record	Doll	B-7 yr.	A	U	30	15	PP
Behavioral Categorical System	DeMyer & Churchill	2-5 yr.	A	U	30	20	P
Psychological Assessment: Functional Analysis	Bijou & Peterson	B-Adult	A	A	U	U	P, PP
COMPREHENSIVE SYSTEMS							
System of Comprehensive Health Care Screening & Service	Scurletis & Headrick	C-4 yr	A	U	U	U	Mix
Rapid Dev. Screening Checklist	Giannini, et al.	B-5 yr.	A	A	5	1	PP, P
Guide to Normal Milestones of Development	Haynes	B-3 yr.	A	A	15	5	PP, P
Developmental Screen. Inventory	Knobloch, et al.	5-18 mo.	A	A	20	10	PP, P
CCD Devel. Progress Scale	Boyd	B-8 yr.	A	A	30	15	PP
Denver Dev. Screening Test	Frankenburg & Dodds	B-6 yr.	A	A	30	15	PP
At Risk Register	Alberman & Goldstein; Sheridan; Oppe; Walker	Pre-C	A	A	Neg	Neg	PP, LT
Risk Factors (Kauai Study)	Werner, Bierman & French	Pre-C to 12 yr.	A	A	Neg	Neg	PP

Notes: (1) Age Range. C = Conception; B = Birth. (2) Reliability. A = Adequate, i.e., greater than .75 when reported or estimated; U = Unknown (data are either unavailable, too variable, or sparse). (3) Validity. A = Adequate, i.e., greater than .75 when reported or estimated (only concurrent and face validity, not predictive). (4) Time. Minutes required for administration and interpretation (estimated average with normal child). U = Unknown; Neg = Negligible amount of time. (5) Cost per Child. Estimated total in dollars including time and materials under optimum conditions. Neg = Negligible cost per child. (6) Administration. P = Professional, trained; PP = Paraprofessional, properly trained; LT = Laboratory Technician; EE = Elaborate Equipment (in laboratory and usually not portable); Mix = Combination of preceding. A trained professional is required to interpret test results.

Adapted from: Meier, 1973. For more exhaustive list, see Cross and Goin, 1977.

where infants were thrown into cold water and only those who could save themselves were kept. Here, I am concerned with the reverse side of the coin, that is, with the early identification of those individuals who are likely to "sink" while they can still either be taught to "swim" in a complex world, or at least properly protected from a fatal total immersion and enabled to crawl, walk, or run on land. A massive early detection and assessment program promises to reveal those factors contributing to DDs in varying degrees and thereby allowing them to be weighted in terms of their relative contribution. This, in turn, will facilitate the prevention of more serious DDs, some of which can be attenuated by early detection and appropriate intervention. Moreover, the appropriateness of various intervention/prevention methods and materials can be determined. Especially relevant to the state of the art of early screening and assessment is the statement in Footnote 2 of Table 2 which points out the inadequacy or absence of predictive validation for most extant tests and procedures used in isolation. This potentially serious problem is largely resolved by the fact that early detection and assessment are best accomplished using the most valid and reliable parts or subtests from a battery of screening instruments and procedures, the composite results of which are more accurately predictive than the sum of the parts, especially when administered periodically during the individual's early years of life by well-trained personnel.

BEYOND THE PARALYSIS OF ANALYSIS

When a satisfactory comprehensive developmental screening and evaluation system has been field-tested and thoroughly "debugged," it is only useful if it is matched with a practical intervention program. Otherwise, a kind of hardening of the categories occurs by which an individual can get stuck with a label and receive little or no assistance in dealing with DD conditions. Table 3 presents a matrix designed to orchestrate many of the multiple considerations involved in screening, evaluation, and intervention. Several appropriate intervention procedures and programs have been reported in the literature. Column V of Table 3 contains a representative, but dated and far from exhaustive, list of such "Intervention and Follow-Along" efforts. (In addition, see Meier & Malone, 1979.)

It is obviously beyond the purview of this paper to elaborate upon the various procedures, instruments, and model programs indicated at various strategic points shown in Table 3. Needless to say, it is most desirable for any potential subject in this system to begin and remain "normal," thus progressing uneventfully down Column II. However, for those who yield positive screening results (in accordance with such criteria as listed in Column III) and are subsequently found to have bona fide DDs, the sooner they are identified and placed in properly matched remediation/prevention programs (such as those suggested in Column V), the better it is for the individual, professionals and paraprofessionals. They bring various requirements to each case and several options are mentioned in Column IV (evaluation) and Column V (intervention).

Today, it is rare that an opportunity for preconceptual analysis would be available, especially for prospective parents who have never conceived before. This is a strong argument for courses and other educational programs aimed at adolescents in junior and senior high school to inform them about the various risk factors and the means for either preventing pregnancy in the first place, or ensuring as many positive conditions as possible for a planned pregnancy. One national movement in recognition of this need is sponsored by the Child Welfare League, which sponsors statewide conferences throughout the United States to address these critical issues. These conferences are held in cooperation not only with school boards, school administrations, health care, and other establishment representatives, but also with the collaborative planning and participation of pregnant and frequently unwed teenage mothers (and occasionally fathers). These young parents have been historically and systematically discriminated against, ridiculed, and maintained in a state of ignorance and shamefulness by a punitive puritanical system, all of which serve to seriously exacerbate the debilitating features of the typically unwanted pregnancy and its attendant responsibilities. These rejecting circumstances then constitute or contribute to the extra-individual origins of DD and, when combined with an intra-individual predisposition to any given DD condition, virtually assure its worst expression.

There are many other reasons and effective techniques for preventing DD which are dealt with elsewhere. However, there are also numerous cautions which should be acknowledged and observed in the case of any massive efforts at early detection and intervention with DD conditions. These are addressed in the series of recommendations which follow.

TABLE 3
SCREENING, EVALUATION, AND INTERVENTION FOR YOUNG CHILDREN AT DEVELOPMENTAL RISK*

I.	II.	III.	IV.	V.
Age	Satisfactory Progress If not--------->	Screening and Risk Assessment If screening results or risk factors are positive----------->	Evaluation, Close Observation and Diagnosis to----------->	Intervention and Follow-Along-------------
PRE-CONCEPTUAL	Intent to Conceive Adaptive & Physiological Readiness (Normal Maternal & Family History)	Presence of One or More Maternal Risk Factors: Physical/Medical 1. Malnutrition 2. Age under 16 or over 35 3. Poor Reproductive History 4. Suspect Metabolic and/or Genetic Disease Social/Behavioral 1. Low SES 2. Sixth Grade Education 3. Functionally Illiterate 4. Low Adaptive Behavior Rating	Nutritional/Metabolic Tests Derive Genetic Pedigree Literacy/Educ. Tests Adult Adaptive Behavior Rating (Nihira)	Genetic Counseling (Sterilization) Diet Therapy Contraceptive Counseling (Planned Parenthood) Maternal Training (Jr. & Sr. High School)
PREGNANCY (1st 3 mo.)	Request for Service (Suspected Pregnancy Confirmed) Regular OB/GYN Checks Normal Progress	Complications During Pregnancy: 1. Infections 2. Rubella 3. Toxemia 4. Drug Overuse 5. Radiation 6. Blood Incompatibility 7. Malnutrition 8. Maternal Psychosis 9. Unwanted Pregnancy	Appropriate Medical Tests to Evaluate Maternal & Embryo Cond. Amniocentesis Social/Behavioral Tests of Maternal Ability & Attitudes	Counseling Therapeutic Abortion Psychotherapy
PREGNANCY (last 3 mo.)	Regular OB/GYN Checks Normal Progress	Above First Request for OB/GYN Services	Evaluation of Maternal and Fetal Condition	Counseling Positive Attitude (Natural Childbirth)
NEWBORN (1st mo.)	Hospital Admission Normal History of Pregnancy and Routine OB/GYN Checks Uneventful Delivery	Complications During Delivery: 1. Hemorrhage 2. Dystocia 3. Excessive Anesthesia 4. Trauma 5. Placental Damage 6. Cesarean 7. Premature (SGA) 8. Postmature 9. Hospital Admission with no prior OB/GYN checks	Appropriate Medical Tests to Evaluate Maternal & Infant Condition	Necessary Procedures to Insure Maternal & Infant Viability

INFANCY	Normal Neonatal Growth & Development	Pediatric Physical and Developmental Exam: 1. Apgar (5 min.) 2. Metabolic/Genetic Screens (e.g., PKU) 3. Trauma 4. Infection 5. Malnutrition 6. Head Circumference 7. Guide to Normal Milestones of Development (at 1 mo.)	Behavioral & Neurological Assessment (Brazelton & Horowitz, at 1 mo.) Environmental Quality Maternal Attitude & Aptitude (Below for specifics)	Sensory Stimulation Behavior Modification Environmental Enrichment Maternal Training (Below for specifics)
INFANCY	Monthly Well-Baby Physical & Developmental Checks (1st year) Normal Progress Bimonthly Physical & Developmental Checks (2nd year)	Physical: 1. Trauma 2. Infection 3. Diseases 4. Malnutrition 5. Vision 6. Hearing 7. Maternal Postnatal Depression/Rejection, Neglect and/or Abuse 8. Prolonged Separation of Infant from Mother Developmental: 1. Rapid Developmental Screening Checklist (at 6 mo. & 1 yr.) 2. Developmental Screening Inventory (at 18 mo.) 3. Developmental Progress Scale (at 12, 18, 24 mo.) 4. Denver Developmental Screening Test (at 12, 18, 24 mo.) 5. Behavior Problem Checklist (at 24 mo.)	DQ: Albert Einstein Scales of Sensori-Motor Development Fantz-Nevis Visual Preference Test White-Held Visually-Directed Prehension Test Gesell Developmental Scale Bayley Scale of Infant Dev. Cognitive Q: Ordinal Scales of Cognitive Development Griffiths Mental Development Kahn Intelligence Tests Infant Rating Scales (Hoopes) Kuhlman-Binet Infant Scales Infant Intelligence Scale Environ./Parent Q: Caldwell (A Procedure for Patterning Responses of Adults & Child.-APPROACH) Parental Attitude Research Instruction Parents' Attitude Scale Wechsler Adult Intelligence Scale (WAIS) Language Q: Irwin Speech Sound Development Test Prelinguistic Infant Vocalization Analysis (Ringwell, et al.) Shield Speech & Language Development Scale Early Language Assessment Scale (Honig) Receptive-Expressive Emergent Language (REEL, Bzoch) Ach. Q: Preschool Attainment Record (Caldwell) P/N Q: Psychophysiological/Neurological Maturity (Brazelton, Crowell) Soc./Behav. Q: Vineland Social Maturity Scale (Doll) Emotional Maturity Adaptive Behavior Scales (Nihira) Pluralistic Assessment (Mercer)	Bobath & Ayres (Physical Therapy) Gordon (Home Learning Center, Florida) Gray, et al. (DARCEE) Heber & Garber (Milwaukee Proj.) Keister (North Carolina Infant Day Care) Lally & Honig (Syracuse Infant Project) Levenstein (Mother-Child Home Program) Parent-Child Center Programs (Costello, Holmes) Meier & Malone (Education System for High-Risk Infants) Robinson (Frank Porter Graham Infant Project) Weikart & Lambie (Ypsilanti-Carnegie Infant Ed. Project) White & Kagan (Brookline)

TABLE 3 (Cont'd)

I.	II.	III.	IV.	V.
Age	Satisfactory Progress If not-------->	Screening and Risk Assessment If screening results or risk factors are positive---------->	Evaluation, Close Observation and Diagnosis to----------->	Intervention and Follow-Along-------------
TODDLER - EARLY CHILDHOOD	**Periodic Physical & Developmental Checks (Approx. every 6 mo.)** **Normal Progress**	**Pediatric Physical Exams (See above considerations) Developmental Screens (Nos. 4, 5, & 6 above)** **Peabody Picture Vocabulary Test** **Goodenough-Harris Draw-A-Person**	**Preschool Inventory (Caldwell)** **Leiter International Performance Scale** **Slosson Intelligence Test** **Raven's Coloured Progressive Matrices** **Stanford-Binet Intelligence Scale** **Developmental Articulation Test (Hejna)** **Illinois Test of Psycholinguistic Abilities (Kirk & McCarthy)** **Verbal Language Development Scale (Mecham)** **Developmental Test of Visual-Motor Integration (Beery)** **Developmental Test of Visual Perception (Frostig)** **Detroit Tests of Learning Aptitude** **Minnesota Preschool Scale** **IPAT Test of G-Culture Fair (Cattell)** **Arthur Point Scale of Performance Tests** **California Tests of Mental Maturity and Personality** **Metropolitan Readiness Test** **Oseretsky Tests of Motor Proficiency** **Wepman Auditory Discrimination Test**	**Model Preschool Programs (by last names of developers: see SOURCES below)** **Anderson & Bereiter** **Blank** **Hooper** **Kamii** **Karnes, Zehrbach, & Teska** **Meier** **Miller & Camp** **Montessori** **Nedler** **Nimnicht** **Palmer** **Robison** **Shaeffer & Aaronson** **Weikart** **Whitney & Parker**

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* Developed by John H. Meier for Governor's Conference on Prevention of Developmental Disabilities, held at Newporter Inn and University of California (Irvine), December 1973. The author gratefully acknowledges the suggestions from Tadashi Mayeda regarding the format of this matrix.

SOURCES: Battle, C. U., & Ackerman, N. C. *Early Identification Programs for Infants with Developmental Delay and Their Families: A Summary and Directory*. Chicago: National Easter Seal Society for Crippled Children & Adults, 1973. Guthrie, P. D., with Horne, E. V., *Measures of Infant Development: An Annotated Bibliography*. Washington, D.C.: Head Start Test Collection, Educational Testing Service, December 1971. Hoepfner, R., Stern, C., & Nummedal, S. G. (Eds.), *CSE-ECRC Preschool/Kindergarten Test Evaluations*. Los Angeles: UCLA Graduate School of Education, 1971. Meier, J. H., & Malone, P. J. *Facilitating Children's Development: A systematic guide for open learning* (2 vols.). Baltimore, University Park Press, 1979. Meier, J. H. *Screening and Assessment of Young Children at Developmental Risk*. Washington, D.C.: U.S. Gov't. Printing Office, 1973. Parker, R. K. (Ed.), *The Preschool in Action: Exploring Early Childhood Programs*. Boston: Allyn and Bacon, Inc., 1972. Williams, T. M. *Infant Care: Abstracts of the Literature*. Washington, D.C.: Consortium in Early Childbearing and Childrearing, August 1972.

RECOMMENDATIONS REGARDING CLASSIFICATION OF HANDICAPPED CHILDREN

A task force commissioned by the Secretary of HEW addressed multiple issues surrounding classification of exceptional children and its impact upon their futures. Among the numerous recommendations issuing from this mammoth study were several which are especially pertinent to the pros and cons of early DD detection (Hobbs, 1975):

> 2.1.2 RECOMMENDATION. The Secretary of Health, Education, and Welfare should encourage, through grants and contracts with appropriate agencies, the development of standardized, quantitative, ecologically oriented profiling systems for work with individual handicapped, disadvantaged, or delinquent children, and the development of models of intervention embracing ecological concepts.
>
> The familiar categories of exceptionality have limited value in planning education or treatment programs for most exceptional children. Assessment of and programming for individual children should be based on periodic analyses of the assets and liabilities of the child and his immediate world, which considered together may be thought of as a circumscribed ecological system, with the child the center. The state of our knowledge at present permits the construction of profiles of the child in relationship with important other people in particular settings, and the specification of actions to be taken on behalf of the child. The goal is to make the system function in satisfactory and rewarding ways by giving specific assistance to the child and to people essential to his healthy development--parents, siblings, teachers, neighbors, agency personnel. Intervention should be focused on reducing disturbance within the system as a whole, not just on doing something to the child. The system must be continuously monitored and profiles revised as the child learns and his world changes; intervention strategies must be adapted or discarded as the system changes. Without constant monitoring and adaptation, these procedures can become as encumbering as the labels they supplant.
>
> 2.2.1 RECOMMENDATION. Because psychological tests of many kinds saturate our society and because their use can result in the irreversible deprivation of opportunity to many children, especially those already burdened by poverty and prejudice, we recommend that there be established a National Bureau of Standards for Psychological Tests and Testing.

(1) The bureau would be a permanent agency responsible to the Secretary of Health, Education, and Welfare. It would set minimum standards for the acceptability of educational and psychological tests for other than experimental use, and it would establish and enforce guidelines to ensure that tests are not used in violation of the equal-protection clause of the Fourteenth Amendment. In cooperation with appropriate professional organizations, it would establish guidelines for the qualifications of test users. It would receive complaints, investigate their validity, and take corrective action where necessary. It would operate an independent research program to improve standards for testing and to assess the validity of claims made for tests by their publishers. The bureau would have a consumer-reports section to disseminate its findings to the public.

At the outset, the scope of work of the bureau would be limited to educational and psychological tests, simply because of their wide availability and use, their significance in determining educational and employment opportunities, and their abuse by incompetent or unprofessional purveyors and practitioners.

Our primary concern is that a substantial and sustained investment in screening programs may result in delay or even indefinite postponement of the development of a satisfactory health program for the nation's children. But screening is clearly to be preferred to almost total neglect of children in high-risk groups, and we therefore here make several recommendations directed toward the improvement of screening programs as a temporary expedient pending the development of comprehensive health-maintenance services for children.

2.3.1 RECOMMENDATION. The objective of the nation should be to serve all families and children through health-maintenance programs, with costs borne, to the extent necessary, by insurance programs or government subsidy.

(1) Routine health and developmental care should provide the context for identifying developmental difficulties of children. Suspected problems should lead to appropriate diagnostic and evaluation studies, and to treatment as may be required. Case finding, evaluation, and treatment should be the responsibility of a single agency, wherever possible. Special screening programs should diminish in importance as comprehensive health and developmental care becomes available.

> (2) At a minimum, in uncomplicated pregnancies, the woman should be examined several times. At a minimum, the child should be examined at birth, at six weeks of age, at two, five, and thirteen years, on leaving school, and at times of sickness or suspected problems. When examinations reveal possible problems, an appropriate diagnostic evaluation should follow, and this should lead to treatment where indicated. These minimum requirements for a national policy emphasizing prevention and early detection and treatment of difficulties are in the interest of avoiding gross unfairness to children. A generous nation concerned with children must do more. The national goal should be nine examinations during an uncomplicated pregnancy and comprehensive physical and psychological examinations in infancy, childhood and youth, in accordance with best pediatric practice. Required treatment should be guaranteed. These are goals already achieved by a number of European nations. Special screening programs for developmental difficulties should not be necessary. (pp. 235-37 & 240-41)

SUMMARY STATEMENTS REGARDING EARLY SCREENING AND ASSESSMENT

Also representative of the high level of national interest in early screening of children at developmental risk, a national conference of interdisciplinary experts on the subject was sponsored by several federal agencies. The proceedings from this conference (President's Conference on Mental Retardation, 1973) contained a list of recommendations which distilled the best thinking of a large group of authorities in a variety of related fields. A synthesis of their carefully conceived caveats serves to close this chapter.

> 1. Any screening and assessment program should take into account all factors of human life and development....The rights of children and their families to participate in decision-making processes should be respected. Screening and assessment should be...service, not research-oriented. Screening should identify conditions which interfere or likely will interfere with effective functioning and for which there are remedial, control, or prevention procedures available. Priority should be given to conditions of highest incidence and/or greatest severity.
>
> 2. Screening and assessment should be seen as a dynamic process that continuously surveys children in the course of their maturation and development.

3. Screening should be viewed as a continuous process beginning at preconception and repeated during the course of the preschool and school years. The purpose of repeated screening at regular intervals is to identify conditions that (a) might have been missed originally, (b) might present themselves at a later age, and (c) might improve with the tincture of time and should be removed from surveillance....Those in high-risk categories require more frequent monitoring whereas the non-high-risk infants may be satisfactorily checked at regular immunization times.

4. Screening without intervention and eventual program planning is futile and may be even detrimental. Positive findings must be combined with careful counseling with the parents in order to maintain or even improve parent-child relationships. The screening certainly must not be painful to the child or harmful to the family.

5. There are numbers of tests, scales, and related procedures that are generally accepted which can be applied in all categories of human functioning....Due to the relatively poorer predictive power of early screening in the cognitive, social, and emotional spheres, mass screening in these areas is contingent upon improved techniques.

6. The simplicity of these initial screening devices should enable the training and utilization of a wide variety of personnel to provide the initial information. Training should be standardized and credentialed....Parents should become involved in the identification process; paraprofessionals can be trained to train parents to be better observers and reporters of their child's development.

7. At each point in the process a coordinator or coordinating agency must be provided to ensure integration of findings and provisions for services. Already existing resources should be encouraged to recognize the need and use of screening procedures and incorporate them into their services. The national network of university-affiliated facilities is a logical mechanism for providing training to all levels of paraprofessionals and professionals and for coordinating a national screening and assessment program.

8. A comprehensive screening and assessment system should resolve problems noted around the whole child and his needs.

This requires improved utilization of existing services and professionals. Similarly, it implies total parental and community education concerning human development, disabilities, and the availability and/or nonavailability of services; high school courses should be developed and implemented for this purpose.

9. The organization and institution of a fully developed program must have sufficient lead time for acquisition and training of personnel and allocation of adequate funds necessary for its success.

10. An improved system of data compilation should be developed to ensure that evaluation and treatment facilities have full knowledge of the past course of a child's development, of all previous test findings, and information about the results of any action taken. Provision should be made for keeping the data confidential. Consider use of Internal Revenue Service or Social Security data collection systems with national records center to help follow transient families. Data must be easily recorded, efficiently retrieved, and properly suppressed to avoid pernicious effects of labeling.

11. A study of the cost-benefits of early identification and intervention programs as contrasted to a late identification and intervention system should be made. The concept of parsimony should be pervasive in the sense of optimum yield for minimum cost to the ultimate welfare of society and the child.

12. Improved techniques should be developed for encouraging participation by and for gaining acceptance of groups which have been designated as "hard to reach." Mobile units such as used in national polio vaccination or hearing screening programs should be one effective approach; training of homemaking counselors in county extension services to do and demonstrate developmental screening in rural, sparsely settled areas is another possibility. Care must be taken to adequately involve low-SES and minority ethnic groups in the planning of a comprehensive screening system and that cultural differences not be interpreted as high-risk factors; nor should screening in any way discriminate against any subculture.

13. Current research findings should be applied to a deliberate working base in screening and assessment.

14. Existing legislation which now is supportive of such early screening and assessment endeavors should be surveyed and compiled. Appropriate consumer pressure groups should be identified to increase percentage of national and local expenditures to eventually ensure that every child receives benefits of routine early screening and assessment for developmental disabilities. (pp. 61-63)

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LEGAL/ETHICAL ISSUES IN EARLY INTERVENTION

William L. E. Dussault

This chapter will focus on three specific legal/ethical areas involved in providing preschool educational programs for handicapped children from birth to common school age (approximately five years of age). These include: the applicability of present federal regulations concerning the protection of human subjects in federally funded research projects; the requirements of informed consent; and record accessibility and confidentiality.

The distinction between ethical and legal considerations is neither spurious nor semantic. Ethics are defined as relating to moral action, motive or character; conformance with professional correctness; or professional standards of conduct. As such, one may be ethical or not depending upon the individual personal perception of "rightness" as to the course of action in the particular situation. Considerations of legality, on the other hand, require conformance to a written and established standard. Such a fixed standard does not allow for the variations of individual perceptions of "rightness" as might be found in an unwritten or personal code of ethics.

While a violation of individual or professional ethics may lead to moral discomfort or even peer pressure and sanction, a discovered violation of law will lead to some legitimized sanction. The purpose of this chapter is to advise those professionals who may be involved in providing preschool educational or intervention programs for handicapped infants of some particularly important legal areas with which they must be concerned. Violation of the provisions noted below may possibly result in an ethical discomfiture, but will likely result in some form of legal sanction.

In the past several years, there has been a growing recognition that the extension of special educational programming to preschool handicapped children can result in substantial and significant educational gains by those children. To a layman, present studies seem to indicate that the earlier in a child's life an appropriate intervention can be made, the greater the likelihood the child will reach full potential. Early childhood intervention or preschool programs have been funded from the local, state, and federal levels. Many of the programs funded are attempting to use innovative approaches to assist handicapped children and their families. The professional area is still open and unstructured, thereby inviting initiative and change.

The possibility for benefit is great, not only to the handicapped child and his or her family, but also to society in general. However, the possibility for harm is also great and pertains equally to both the child and his family and society. Because many of the intervention and educational techniques are new, they are experimental in many respects. Some will be tried, found wanting, and rejected. It is likely that we will be unable to accurately predict the potential for harm present with many new techniques. While a particular behavioral technique may work appropriately and well with one disabled child, a very similar disabled child may suffer severe negative consequences from the application of the same technique or from the application of that technique in a slightly different method or context.

It is with an understanding of the risk involved in such programs that the federal government has entered the arena to attempt to provide protection for the persons who are at "risk." On July 12, 1974, the National Research Act (P.L. 93-348) was signed into law, creating the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. In the years since 1974, the National Commission has studied several areas of research and recommended regulations to the Secretary of Health, Education and Welfare covering such research. As will be seen by the discussion of the federal regulations which follows, many, if not all, of the early childhood education and/or intervention projects currently being funded will fall under the provisions of these rules and regulations.

Basic regulations governing the protection of human subjects supported by HEW funds were published in the Federal Register on May 30, 1974 (30 F. R. 18914), now codified at 45 C. F. R., Sub-title A, Part 46. These regulations were intended to apply to all HEW grants and contracts supporting research, development, and related activities in which human subjects are involved (45 C. F. R. 46.1[a]). The comments to the regulations indicate that the regulations are intended to be all-inclusive. "Students" were intended to be included unless later specifically excluded by additional rules and regulations promulgated by the Secretary. The regulations required review of a project by a "committee of the organization" (the grant recipient) to determine: (a) the risk involved to the individual and whether or not it is outweighed by the benefit; (b) the rights of the subject individual which are to be protected; (c) whether or not informed consent has been properly obtained; and (d) to review the project at appropriate intervals for compliance. The risk to the individual was defined in 45 C. F. R. 46.3(b) to include "the possibility of injury including physical, psychological, or social injury as a consequence of participation as a subject in any research, development or related activities which departs from the application of those established and accepted methods necessary to meet his needs which increases the ordinary risk of daily life."

It is clear from a reading of the regulations as a whole and review of the comments thereto, that the coverage of the regulations was to be extremely broad. In the prologue to the regulations, comments indicated that additional regulations would be promulgated covering such areas as research with children, research with prisoners, and research involving those institutionalized as mentally disabled.

Proposed regulations governing research with children were published on July 21, 1978 (43 F. R. 31786), codified at 45 C. F. R., Part 46, Sections 401-410. Comments to the regulations concerning research with children were extremely helpful in clarifying what sorts of activities were being defined as research. At page 31792, the comments pointed out that virtually all "research" would be covered by the regulations, including: research involving the taking of surveys; research solely involving observation of programs; research based solely upon review of existing records; and research involving achievement and aptitude testing. The comments even went so far as to include "participation in instructional and other programs carried out in a normal educational setting where the program is generally similar to other programs in the school curriculum and has been approved by local school board or a parent advisory group." All of the above activities are included as research and are covered by the federal regulations. However, as with the earlier general regulations, there was an indication that exceptions to coverage might be considered in future rule-making.

Regulation 46.40(1)(a) indicated that coverage extends to all HEW-funded biomedical and behavioral research. Regulation 46.40 (3)(d) defined research as a formal investigation designed to develop or contribute to generalized knowledge in such fields as the behavioral sciences, including psychology, educational psychology, or sociology. The basic thrust of the regulations operates on the assumption that the greater the risk to the individual subject, the greater the procedural protection that must be applied. Even where there is minimal-to-no risk, certain assurances must be provided by the recipient's Institutional Review Board (see earlier regulations) and informed consent must be obtained.

Additional proposed rules were published on November 17, 1978 (43 F. R. 53950), now at 45 C. F. R., Part 46 of 501-508, concerning research involving those persons institutionalized as mentally disabled. The latest regulations add to the protections afforded in the earlier rules. If an early childhood program involves children who reside, whether by voluntary admission or involuntary confinement in institutions for the care and treatment of the mentally disabled, they would be covered both by the earlier regulations concerning children and the later and stricter regulations concerning institutionalized individuals. The individuals covered include, but are not limited to, patients in public or private mental hospitals, community mental health centers and halfway houses, and nursing homes. The latter could probably be interpreted to include children living in state-supported group or foster homes. It is entirely likely that many of these children will be participants in community-based early education and intervention programs.

As indicated earlier, the purpose of the regulations is to provide assurances that, as the risk to an individual participant increases, so too does the procedural protection for that individual. The recipient's Institutional Review Board is required to assure, among other things, the following:

a. That the methods used are appropriate to the aims of the study.

b. That the investigators are competent.

c. That where appropriate, the methods have been previously tested on either animals or adults who are less at risk.

d. That the individual risk is minimized as much as possible.

e. That the subject's rights of privacy and confidentiality are protected.

f. That the parents or guardians of the subject child are involved or as the risk increases, that independent advocates are involved.

g. That where appropriate the consent of the child is obtained and that in all instances, the informed consent of the responsible adult is obtained.

The above is not intended to be an exhaustive listing of the requirements of the rules and regulations. It is intended to point out the existence of the rules and regulations and their applicability to the majority of programs being undertaken. As with many federal programs, violations of the rules and regulations will lead to the withholding of federal funds previously granted and still due. More importantly, however, violations of these rules and regulations could lead to private civil litigations for damages being brought against the programs for violations of the rights of the individuals involved. Such suits would be wholly separate and apart from any federal agency action affecting the grant. The potential for liability in the future could be substantial, in the event that the rights of the research subjects are not protected as required in the regulations.

INFORMED CONSENT

In the above discussion concerning the federal regulations, the term "informed consent" has often been used. It is a basic requisite to participation in any of the funded activities covered by the regulations. In addition to the federal regulations, there is a growing body of statute and case law that also requires informed consent. "Informed consent" is the general rubric applied to the process of obtaining a legally valid and binding consent to participation in programs, treatments, therapies, and other forms of activities that may result in physical, psychological, or social jeopardy to the participant. Basically, informed consent is the knowing and voluntary agreement by one individual, who has the necessary legal capacity to make such an agreement, to participate in some activity after that individual has received all legally necessary information concerning the activity.

HISTORY

The doctrine is historically based in the English Common Law of assault and battery. Given two people of equal class or status, it was clear that one person could not touch or otherwise infringe upon the person of the other without prior consent or permission. The doctrine has now been extended to cover far more situations than those traditionally known to be the criminal violations of "assault and battery." For instance, we now recognize that prior to the performance of any medical procedure, whether it be surgery, therapy, or possibly even the prescription of drugs, an informed consent by the patient must be obtained. Many other situations and circumstances have also been held to require the informed consent of the participants. The federal regulations noted above clearly require informed consent in all "research" projects funded by HEW.

Consent may take the form of a document entitled, "Consent to Participate," or it may be called a release or a waiver. The name of the document is not as important as what the document is attempting to do. Such documents are an attempt to obtain pre-participation permission and/or pre-participation release from potential accident, injury, or damage arising from participation in the activity. Current trends in the law indicate that the application of the doctrine of informed consent may continue to expand.

BASIC ELEMENTS OF INFORMED CONSENT

The basic elements of informed consent require that the individual who is to give consent have the legal capacity to do so, that the consent be given voluntarily, and that the consent be given knowingly after receipt of sufficient and appropriate information. Each of the elements will be discussed below.

CAPACITY The legal presumption of competency is universal for all adults. Note the emphasis here is that the presumption pertains to adults and not children. Persons under the age of 18 (the age of majority) are not presumed to be competent. Decisions made or consents given solely by such children will not likely be valid. Only the consent or permission given by the parent entitled to custody or other appropriate court-appointed individual in the absence of such a parent will be legally binding for that child.

Having stated the basic legal presumption that adults are competent, it's important to note that both the courts and many legislatures recognize that there are many individuals who have reached the age of majority, but who are not functionally competent. Such adults may be actually declared incompetent by a court of law and placed under a guardianship or limited guardianship, or may not have come before the jurisdiction of court for such a determination. It will be up to the individual requesting the consent to obtain either proof of incompetency and guardianship, which can easily be demonstrated by a court order, or to make some prima-facie determination as to the consenting individual's actual competency. Such a prima-facie determination should be carefully made and accurately documented.

VOLUNTARINESS In order to be valid, the consent given by the participant must be voluntary. The person requesting the consent should review any inherently coercive elements presented by the participant's situation. For instance, if a participant is living in a group or foster home and the group or foster home parent is actively promoting participation, the participant may fear retribution in the event that consent is not given. If consent is being asked of a parent for a child's participation, an effort should be made to determine if there are any outside influences coercing such participation. A parent may be told by a public welfare agency that as a condition of remaining eligible for benefits, the child must participate in the program. Such elements should be reviewed and, if possible, eliminated.

NECESSARY INFORMATION After the person requesting consent has determined that the participant or the participant's parent or guardian does have the necessary capacity to provide consent and is in a situation that would allow that consent to be voluntary, the person requesting consent must then review the specific activities in which the participant will be involved. Information concerning the activity must be provided to the participant or parent in a language that is reasonably understandable to the participant or parent. Quite often professionals tend to adopt words and phrases that are understood only by other professionals. The information that is to be provided should be given in simple, non-professional language. It may even be necessary to obtain an interpreter to translate the information into the primary language of the participant in the event that the individual does not speak English as a primary language. The specific elements of information are as follows:

1. The participant should be given a full and complete description of the intervention, program or therapy to be attempted. The description need not be exhaustive but should cover all primary and salient points.

2. Though it might seem obvious, the participant should be given a description of the benefits to be expected from participation in the program.

3. The participant should be provided with a full description of all significant and non-inconsequential risks involved in participation. Since many of the educational programs may involve innovative behavioral and educational techniques, a discussion of the risks may be difficult. It will require an honest, professional appraisal. It would not be appropriate to presume that all educational interventions result in positive outcomes. Nor could one assume that a behavior modification application might not have negative consequences. The greater the possible risk, the more explicit the explanation should be. It is not the purpose of the description of the risks to place the participant in actual fear or to frighten him out of participating in the activity. It is, however, the purpose to honestly apprise him of any potential for harm that might arise from participation.

4. The fourth element requires a full description of any available alternative programs, or options for the participant, and an indication as to why those programs or alternatives are not being recommended. The participant should always be advised that he or she has the right not to make a decision and not to participate in any programs. While that may not be a preferable alternative, it is certainly one that is available.

5. The participant should be fully advised that he or she can change his or her mind at any time throughout the conduct of the program or activity.

It is likely any project director will have many children and parents involved in making decisions as to whether or not to participate in a project or activity. It would be difficult for that individual to remember what information was given, when it was given, and what the responses were. The only protection such a program director would have would be a written record which documented the elements of capacity that were present, covered the issue of voluntariness, noted the information given to the participant, formally recorded any recommendations made by the project director, and finally, recorded questions and answers asked by the participant or his or her parents.

INDICATION OF CONSENT

After each of the elements of informed consent has been satisfied, one thing still remains. The participant or his responsible adult must actually indicate a consent. If you can imagine the informed consent procedure as it might be depicted in a comic strip, actual understanding and consent would be shown over the client's head by a lightbulb turning on. In some manner, the program administrator is going to have to determine that "the lightbulb" has turned on. The consent might be demonstrated by a nod of the head, by an affirmative statement such as, "Yes, I consent" or by facial features or physical actions that convey an assent. The person who is requesting the consent should accurately report what the individual did to indicate consent. Further, observations indicating that the person giving the consent actually understands should be made. A blank and uncomprehending stare, coupled with an incomprehensible mutter, would probably not be sufficient to constitute consent.

CONSENT LITIGATION

We are entering a period of time when the protection of the legal rights of children, and more particularly the legal rights of disabled persons, are going to be at issue in civil litigations brought by participants in such programs and in litigations brought by the federal government. The informed consent process if properly applied can play an important role in the protection of the participant's individual rights. Additionally, if properly documented by the program administrator, the procedure can be invaluable insurance to the program.

ACCESS TO RECORDS

The third area of concern to be reviewed in this chapter concerns the parent and/or student's access to records maintained by the preschool or intervention program. As with the research and informed consent areas discussed above, this has been an active area for litigation and legislation in the past several years. In order for a discussion of access to records to be meaningful, the discussion must be bifurcated to refer to (a) educational records and (b) treatment records.

EDUCATIONAL RECORDS

There has been a substantial amount of federal legislation and regulation in the area of educational records (those records maintained by an educational agency or institution or by a party acting for the agency or institution which are directly related to a student; reference 45 C. F. R., Sub-title A, Part 99.3). Pursuant to the Family Educational Rights and Privacy Act (commonly known as the Buckley Amendments), HEW published regulations on June 17, 1976 (41 F. R., page 24662), 45 C. F. R., Sub-title A, Part 99, concerning the privacy rights of parents and students. Section 99.11 of those regulations states that "each educational agency or institution ... shall permit the parent of a student or an eligible student who is or has been in attendance at the agency or institution to inspect and review the education records of the student."

The definition of education records, *supra*, does not include records relating to an eligible student which are (1) created or maintained by a physician, psychiatrist, psychologist, or other recognized professional who is acting in his or her professional capacity; (2) created, maintained or used only in treatment to the student; and (3) not disclosed to anyone other than individuals providing treatment. However, that exclusion goes on to indicate that "for the purposes of this definition, treatment does not include remedial educational activities, or activities which are part of the program of instruction at the educational agency or institution." Accordingly, unless the record contained in the student's educational file relates solely to the student's treatment as contrasted with his educational program, the record must be disclosed to the parent and the student as appropriate. The Buckley Amendments are applicable to all programs funded by the Office of Education of HEW, excluding such programs as Head Start or Educational Research Programs conducted under the National Institute of Education.

P.L. 94-142, the mandatory Education for All Handicapped Children Act, also contains provisions regarding access to records. 45 C. F. R. 121A.560 requires that the student's privacy and the confidentiality of records be maintained as required in the Buckley Amendments referred to above. The same types of procedures and rights are granted. Access to the records is also specifically granted. Moreover, 45 C. F. R. 121A.505(a)(3) requires that the parent or student must be advised of each evaluation, test, record or report used by the district when the district makes a determination regarding the appropriate educational placement, identification, evaluation, or educational program for the student.

Finally, the regulations promulgated pursuant to Section 504 of the Vocational Rehabilitation Act of 1973 (29 U. S. C. 706) found at 45 C. F. R., Sub-title A, Part 84, requires in sub-part D, Preschool, Elementary, and Secondary Education, Section 84.36 that, "a recipient that operates a public elementary or secondary education program shall establish and implement ... a system of procedural safeguards that includes notice and opportunity for the parents or guardian of the person to examine relative records, an impartial hearing ..." Thus, the laws and rules and regulations with regard to educational records absolutely require that the parent, and the student where appropriate, have full and complete access to any educational record that is developed concerning that student.

TREATMENT RECORDS

As indicated in the discussion of the Buckley Amendments above, there appears to be a distinction between educational records and treatment records. There are few cases or statutes that directly discuss "patient" access to treatment records. It would appear that the recent trends in federal and state legislation and cases may indicate that such individuals do have a right to access to their records.

The rationale often used for denying individuals access to treatment records is that the individual won't understand the contents of the records, or if they do, they may be harmed by that knowledge. There is a growing belief that is an erroneous assumption. The reality is that most individuals are capable of understanding their treatment records with adequate explanation. People today appear to be more informed, knowledgeable and capable of understanding such matters than in the past due to increased educational opportunities, mass communication and urbanization of our society.

Nine states have statutes that specifically allow "patients" or their attorneys to inspect their treatment records. Two of these states even have sanctions for refusal to disclose. Public records acts (analogous to the Federal Freedom of Information Act) have been enacted in 25 states. Over half of these statutes do not specifically exempt treatment records. Therefore, patients at public facilities can invoke these acts to gain access to their records. Early cases involving access to treatment records used a strict and narrow interpretation of the common law rules of personal property, holding that the ownership of patient's records resided in the care provider. In more recent cases, however, the courts have departed from this analysis and have held that, although the service provider has an absolute ownership and right of possession of the original record, the patient also has a right to the information contained in the record and is absolutely entitled to a copy of the hospital records. See Emmett v. Eastern Dispensary and Casualty Hospital, 396 Fed. 2nd 931(D. C., 1967); and Wallace v. University Hospital of Cleveland, 164 N. E. 2nd 914(Ohio, 1959). The philosophy of the courts appears to be, in rendering these decisions, that the records are kept for the benefit of the individual receiving the treatment, the facility providing the treatment, and the treatment provider. The records are viewed as an essential part of the contractual relationship between the treatment provider and the recipient.

Like it or not, treatment providers are in the role of service providers and the recipient is the consumer. This carries with it the notion of equality in the relationship and equality of bargaining power. This is a difficult notion for many physicians and treatment providers to accept. The fiduciary relationship between treater and recipient and the right of the recipient to a full and frank disclosure of all facts relating to the treatment now appear to be increasingly requiring that the patient have access to records. While the trend in the court appears to point towards greater access to records, the laws in each individual state should be reviewed for a definitive answer. One thing is clear, the "sensitivity" of material contained in such reports is no longer controlling as to the patient's access or disclosure of the material.

If the records relate to educational programming, they will have to be disclosed. If on the other hand, they concern solely the "treatment" of an individual much on the level of a doctor/patient situation, disclosure may or may not be required.

CONCLUSION

After reading a paper covering new and extensive legal prerequisites of programs there is a great temptation to simply throw up one's hands and refuse further involvement. That attitude would be extremely unfortunate.

The legal protections established by the courts, Congress, and administrative agencies are merely formalized recognitions of desired ethical levels. They are not meant to prohibit the conduct of such programs. They are meant to establish minimum standards for the protection of all individuals involved.

Part 2

Applications

EARLY MOTOR DEVELOPMENT: ASSESSMENT AND INTERVENTION

Marcia W. Swanson

It was reported recently that a researcher in child development endeavored to follow an infant through his daily activities, replicating all of his movements and postures. The researcher was only able to do this for a few hours before he gave up, physically exhausted. This is perhaps the best commentary on the motor behavior of an infant: its complexity, its centrality in the life of a young child, and its challenge to those of us who attempt to assess and influence the motor development of handicapped or delayed infants.

There are a number of issues which could be discussed under the topic: motor development in infants, assessment and intervention. This chapter will concern itself primarily with the assessment of the handicapped infant as a means of determining not only his level of function, but also the reason for his motor impairment and the appropriate focus for intervention. It will not attempt to compare the various developmental scales and profiles commonly used. They are numerous, and each developmental center tends to have its own reasons for favoring a particular set of scales. Instead, after discussion of some of the general limitations of these scales, this chapter will go beyond the standard developmental profile to consider the underlying components of movement, such as reflexes and balance reactions and their developmental progression. Finally, it will attempt to illustrate the importance of an understanding of the basic movement components in the design and implementation of an intervention program for the handicapped child.

BEYOND THE DEVELOPMENTAL SCALE

The motor behavior of an infant or young child is generally "assessed" by plotting the child's observed motor skills on a scale of normative developmental activities. In this way, the child's "functional level," relative to a selection of normal children, is established. Intervention is directed at assisting the child to reach higher level skills with periodic re-evaluation of the child's position on the scale to measure progress.

This traditional approach to motor development has several basic problems. First, the profiles themselves have significant limitations. Few standardized assessment tools of motor development are available. Two most frequently used standardized measures, the Gesell Developmental Schedule (Gesell & Amatruda, 1967) and the Bayley Scales of Infant Development (Bayley, 1969) are both comprehensive evaluations of all aspects of a child's behavior -- language, cognitive, social, as well as motor development. While an evaluation of the total child may often be appropriate, these tests do not give sufficient attention to motor development for thorough assessment. Also, significant disparity exists between the maturational levels determined for a given child by these two instruments, with the disparity being most profound in the motor portions of the scales (Eipper & Azen, 1978). Moreover, the increments between the skill levels on these two instruments are too broad to meaningfully assess the motor performance of a handicapped child or to be sensitive to developmental change.

The need for a more detailed breakdown of the sequential acquisition of motor skills has led to the creation of numerous nonstandardized developmental profiles and checklists. These include the Learning Accomplishment Profile (Sanford, 1976), the Portage Project checklist (Shearer, 1972), Developmental Pinpoints (Cohen & Gross, 1979), Developmental Programming for Infants and Young Children (Schafer, 1977), and Peabody Developmental Motor Scales (Folio & DuBose, 1974). These profiles provide a more refined analysis of a child's competency level in a variety of motor skills. Many profiles are accompanied by programs which give suggestions for building prerequisite components necessary for higher function. However, these more refined profiles also have their limitations. Because they frequently represent compilations and modifications of numerous standardized and nonstandardized scales, the profiles vary considerably in their assignment of a particular skill to a maturational level. Also, they often lack adequate clarification of test administration procedures. Consequently, their value in accurately determining a child's "developmental level" is questionable.

A second and more fundamental question is the relevance of any normative developmental scale or profile to an assessment and intervention program for a delayed or handicapped child. The normal developmental age schedules, the standard rate of developmental achievement, and, in many cases, the skills being measured, may not be pertinent to a child who is known to have a neurological impairment. Therefore, assessment based on comparison of the handicapped child to a normal developmental sequence may be of limited usefulness. Using only a developmental profile as a reference, an assessment can yield little information on the quality of movement patterns or the developmental progression of individual motor skills. It does not suggest why certain movements are abnormal in character, why particular skills are delayed and, finally, it cannot adequately measure meaningful as well as functional change and progress as the result of an intervention program.

A language evaluation does not only consider a child's spoken vocabulary. It also evaluates a child's receptive language, the oral structures, auditory functioning, and possibly the cognitive achievements which are recognized to be prerequisites for language. Similarly, a thorough assessment of a child's motor behavior is more than a measure of the child's motor performance. It must consider the adequacy of the underlying neuromuscular elements necessary for movement, the postural and balance mechanisms, and the movement patterns within volitional activities. Since scales and checklists in these areas are only beginning to emerge, evaluation is less structured and programmed but not necessarily less objective and certainly not less essential to planning an individualized intervention program.

The professional staff of an infant developmental center should include a physical and/or occupational therapist to assess the children, develop individual intervention programs, and implement these programs. An in-center therapist should be regarded as a program funding priority, for without a therapist, the responsibility for the children's motor development must be assumed by the teacher who typically does not have the time or professional expertise which is required. This chapter therefore is not an attempt to make therapists of teachers. However, it recognizes that many developmental centers do not have adequate therapy services in spite of sincere efforts to obtain a therapist. Moreover, motor development is so predominant in a young child's experience and so intrinsically related to cognitive, social, and even language development, that it is important for educators working with this age group to have an understanding of the processes, mechanisms, and components of movement. Without this knowledge, they cannot be expected to teach the child who has delayed or abnormal motor development.

ASSESSMENT: ELEMENTS OF MOVEMENT

Functional motor development is dependent upon the integrity and maturation of the neurological system. The quality of neural mechanisms underlying movement is reflected in four primary elements: muscle tone, primitive reflexes, automatic postural reactions, and the character of volitional movements. Although these terms, and indeed, the "neurological" aspect of "neuro-development" may seem mysterious, technical, and irrelevant to educators, they can and should be meaningful to all who work with handicapped children. It is hoped that a brief discussion, with direction toward a number of excellent references in each area, will make these basic components of movement more approachable and thus more naturally included in an evaluation of a child's motor behavior. Each of the four elements will be introduced separately but their close interrelationship within normal and abnormal development will be explored.

MUSCLE TONE

Muscle tone refers to the degree of tension in the muscles when an individual is at rest, i.e., not actively moving. A precise physiological description of muscle tone has been debated and avoided by medical persons and therapists for many years, and an explicit definition will not be attempted here. However, several characteristics of muscle tone should be mentioned. Muscle tone provides the basis for posture upon which involuntary and voluntary movements are superimposed. Normal movement requires sufficient muscle tone to maintain an erect, upright posture but not so much tone that motion at a joint is limited and mobility is restricted. The muscles on either side of a joint, those that bend and straighten the joint, must be balanced in their degree of muscle tone or one force will overpower the other and an abnormal posture will be assumed. Although it is manifested in the muscles, tone is actually regulated by the central nervous system from centers in the lower brain. The degree of muscle tone in a given individual is generally consistent throughout the body and normally remains constant from infancy throughout life.

A quantitative, objective measure of muscle tone is not possible, and the existing graded scales of muscle tone are admittedly subjective (Prechtl, 1977; Touwen, 1976). However, it is possible to obtain a general impression of the quality of muscle tone in a child. Knowing whether a child is basically hypotonic (low muscle tone) or hypertonic (high muscle tone) is critically important when handling and working with young children. Evaluation of muscle tone includes both specific movements of the limbs by the examiner while the infant remains passive, as well as non-intervening observation of the child's spontaneous posture and active movements (Amiel-Tison, 1976; Andre-Thomas & Dargassies, 1964; Brazelton, 1973; Prechtl, 1977; Touwen, 1976).

One of the most direct ways of assessing muscle tone is to feel, or palpate, the consistency of the muscles, particularly in the calf, thigh, and arm. Muscles of normal consistency feel firm, with some definite bulk, but are not hard or stony. The hypotonic muscle feels flabby and soft with little distinct shape. The range of movement, or extensibility within the joints, especially the shoulder, hip, and ankle joints, is another indication of muscle tone. Hypermobility of the joints is often associated with low muscle tone while limitation in range of motion may be due to high muscle tone. Muscle tone is also manifested in the resistance of limbs and trunk to passive movements. The passive force can be exerted either by the examiner shaking the limb at the ankle or wrist, a technique of testing for passivity, or by moving the limbs rhythmically through their full range of motion. One notes whether the limb moves easily and smoothly with some resilience but not so much as to restrict the motion. In the hypotonic child, the limb may be floppy with no resistance to the passive movement.

Gravity also exerts a force, and tone can be evaluated by observing the child's posture. The hypotonic child offers little active resistance to the pull of gravity and his body appears to "melt" into the supporting surface, often with legs spread, arms resting on the ground. The muscles of the hypertonic child may be too active and his limbs and body may be too tightly flexed, bent, or rigidly extended, depending upon his position.

In evaluating muscle tone, the above observations are combined with an assessment of how the child moves independently and how he feels when held to determine if it is characteristic of a rather limp, floppy, hypotonic child or a stiff, tense, hypertonic child. Since the conclusions drawn from these observations are somewhat subjective, an accurate assessment of muscle tone requires experience in handling and observation of normal infants and young children.

PRIMITIVE REFLEXES

Primitive reflexes are involuntary, stereotyped responses of a limb or the whole body to a specific environmental stimulus. They are generally present at, or shortly after, birth. Familiar primitive reflexes include the *asymmetrical tonic neck reflex*, or *ATNR*, (turning of the head to one side elicits extension of the limbs on the face side and flexion of the limbs on the skull side) and the *Moro* reflex (abrupt extension of the neck causes the arms to fly out with fingers spread). Primitive reflexes are mediated at lower levels of the brain. As the infant matures and higher brain centers become more active, the influence of the primitive reflexes diminishes and they gradually become fully integrated into more functional activity. By four to six months of age, the influence of primitive reflexes on motor behavior should be minimal. Persistence of primitive reflexes beyond this age or presence of a reflex which is obligatory and dominates the child's motor behavior is indicative of neurological impairment.

Any assessment of primitive reflexes must therefore be correlated with age level. A review of the chronological sequence of the appearance and dissolution of primitive reflexes, as described by different examiners of reflexology, confirms the variability and inconsistency of reflexes in normal infants. The course of primitive reflexes in children with developmental disorders is also extremely variable. For example, in children with cerebral palsy, the number and pattern of retained reflexes are not predictably related to either the type or severity of involvement. In children who are mentally retarded but without specific motor impairment, primitive reflexes are generally not retained although disappearance of the ATNR may be delayed (Molnar, 1978; Paine, 1964). Consequently, assessments which only record the presence or absence of reflexes do not provide conclusive information regarding the existence or severity of a child's impairment (Andre-Thomas & Dargassies, 1964; Fiorentino, 1972; Hoskins & Squires, 1975; Milani-Comparetti & Gidoni, 1967).

Reflex examinations which grade the strength of individual reflexes, distinguishing transient appearance from sustained or obligatory response, can be more helpful in assessing the significance of a reflex and in following its influence longitudinally in a child (Barnes, Crutchfield, & Heriza, 1978; Brazelton, 1973; Capute, Accardo, Vining, Rubenstein, & Harryman, 1978; Prechtl, 1977). For clinical value, qualitative aspects of the reflex must also be considered. For instance, if a Moro reflex is elicited when rolling the child from front to back, as well as in the more conventional sitting position, it would have implications for how the child should be handled. Or, if a persistent ATNR causes hip internal rotation and adduction on the flexed side, the child may be at risk for hip dislocation.

Most important for a clinical assessment is an understanding of the relationship between a persistent reflex and the child's ability to achieve normal developmental skills. For example, it is obvious that a child with a strong retained palmar grasp reflex will be impaired in his development of voluntary grasp. Because his hand is persistently fisted, he will have limited sensory input or opportunity for tactile exploration. A child with a dominant ATNR will not be able to bring an object in his hand to his eyes or mouth, for as long as his head is turned toward that side the arm remains extended. Similarly, consider the positive support reflex in which pressure on the balls of the feet causes rigid extension of the hips and knees. When this reflex is strong, the ankles are extended so the child is standing on his toes, usually with feet close together. In the normal infant this reflexive standing is followed by more relaxed weight-bearing on the lower extremities. If the positive support reaction does not diminish, and especially if the pattern is reinforced by extended time spent in an upright position in a walker or jumper, the legs remain stiff. The normal development of standing, with the flexibility, weight shift and leg separation necessary for early walking, will not occur.

AUTOMATIC POSTURAL REACTIONS

Automatic reactions, also referred to as the normal postural reflex mechanism (Bobath & Bobath, 1964), are involuntary, unconscious responses of the body and limbs to changes in the position of the body in relation to gravity and to changes in the alignment of the body parts. Automatic reactions provide the constant underlying postural adjustments to one's own movements and motion in the environment so that the movement is not disruptive to one's equilibrium. The automatic reactions consist primarily of righting reactions, equilibrium reactions, and supporting reactions.

Righting reactions maintain the head in a vertical position in space so that the eyes are horizontal. This reaction, which originates in the labyrinths of the inner ear, serves to automatically right the head from any position, stimulating raising the head in the prone position as well as righting the head laterally when coming from a side-lying to a sitting position. The body righting reaction (or derotative righting [Milani-Comparetti & Gidoni, 1967] or segmental rolling [Capute et al., 1978]) functions to realign the body following rotation around the body axis. For example, if the child in the supine position reaches with both hands for a toy to one side of his body, his trunk will twist; the hips will then follow and he will roll in a segmental fashion to side-lying or to prone.

Equilibrium reactions, or tilting reactions, are compensatory adjustments of the trunk and limbs to disturbance of the center of gravity caused by displacement of the body or movement of the supporting surface. The responses involve characteristic movement patterns of the trunk and extremities but they are not stereotyped, since there is considerable variation among normal individuals as well as inconsistency within a single individual's reactions. The essential components of the equilibrium reaction are lateral curving of the head and trunk with the concavity on the elevated (or non-weight-bearing) side, and abduction of the extremities on the upper side as counterbalancing reactions.

Supporting reactions of the extremities include protective extension reactions of the arms and downward parachute reactions of the legs. When the weight of the upper trunk is rapidly shifted to one side, forward or backward, the arms immediately abduct and extend to prevent a fall by support on an open hand. Similarly, when a child is lowered quickly to the floor feet first, the legs immediately abduct and extend to provide a stable supporting surface on flat feet.

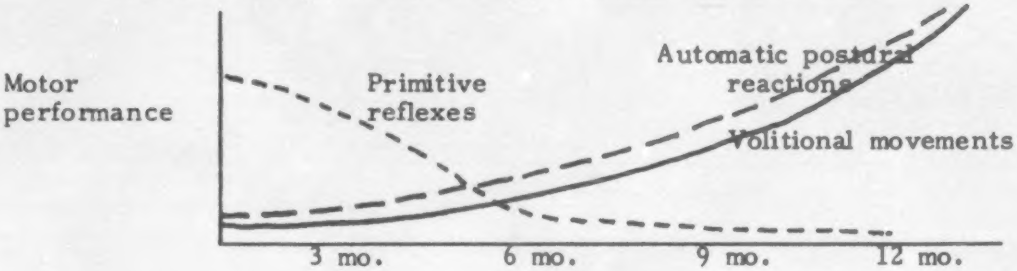
The automatic reactions are not present at birth but emerge gradually in a predictable time sequence integrally related to achievement of developmental milestones. A child first develops the ability to maintain a posture such as prone or sitting. With time and the experience of mobility and weight shift in that posture, the equilibrium reactions in the position mature. For example, a child usually can sit independently by seven to eight months but equilibrium reactions in sitting are not fully developed until eight to ten months. It is important to recognize the developmental sequence in assessment of automatic reactions. The child should be tested in a variety of positions -- the standard developmental positions being prone, supine, sitting and standing -- utilizing a lap or cushion, a ball, or tilt board depending on the size of the child. In order to elicit a full response, it is essential to fully shift the child's weight to each side.

Most assessment scales record only the presence or absence of the reaction without grading the maturity of the response or the characteristics of the responsive movement pattern (Barnes, 1978; Hoskins & Squires, 1975; Milani-Comparetti & Gidoni, 1967). Qualitative observations of a child's responses when balancing can provide very important information regarding neuromuscular integrity. Attention should be given to any asymmetry between the response in the two sides, any abnormal movement patterns such as strong extension and abduction of the lower extremities, and any failure or inability to maintain a counterbalancing response. A child may compensate for a deficit in one aspect of his motor development by a deviant response. For example, if muscle tone in the trunk is low and the trunk reactions are not well developed, he may tend to rely on his extremities for balance either by gripping or clinging with his hands or toes, by using exaggerated counterbalancing responses of the arms, or exhibiting hyperactive protective extension reactions. Conversely, a child who has poor weight-bearing capacity through his arms may balance entirely with his trunk and avoid taking any weight on his hands. If the abdominal muscles are weak, a child can compensate by bending his hips or hyperextending his spine so he is not required to use his abdominal musculature. A child may have adequate equilibrium reactions in his trunk in sitting but lack the necessary foot reactions to balance in standing and will compensate by taking excessive steps with his feet.

Normal development of motor function, which implies acquisition of appropriate developmental milestones performed with mature, coordinated movement patterns, is dependent upon inhibition of the primitive reflexes and emergence of the automatic reactions. The precise timing of these developmental events is not as important as the proper sequence of reflex diminution and appearance of the postural reactions. Delay in one component can retard the achievement of more mature skills (Molnar, 1978) (see Figure 1). For example, to roll, a child must have developed head righting, body derotation righting, and equilibrium reactions in prone. Retention of an ATNR, or influence of the tonic labyrinthine reflex in supine (in which there is excessive extensor muscle tone when the child is on his back) will impede rolling. Creeping on hands and knees requires trunk control associated with righting and equilibrium reactions in sitting, forward protective extension reaction of the upper extremities, derotative righting, and beginning equilibrium reactions in a quadriped position. Persistence of an asymmetrical or symmetrical tonic neck reflex, tonic labyrinthine reflex in prone (in which there is increased flexor tone when the child is on his tummy), or palmar grasp, will cause abnormal or delayed creeping.

Therefore, thorough assessment of the status of primitive reflexes and postural reactions can pinpoint the deficit in a child's delayed development.

FIGURE 1
MOTOR DEVELOPMENT IN THE FIRST YEAR OF LIFE



If there is a delay in the integration of a reflex or the development of a postural reaction, the volitional movement curve will shift to the right.

VOLITIONAL MOVEMENTS

On the foundation of normal muscle tone and postural reactions, a child builds increasingly complex volitional motor skills which are measured by many developmental scales. In addition to determining his functional level, it is essential to analyze the quality of a child's volitional movements. Within the first year of life, a newborn, virtually helpless motorically, is transformed into an erect, mobile individual capable of purposeful interaction with his environment. This transformation is a result of the gradual development of four components of mature movement: extension, symmetry, independent movement, and rotation.

The development of extension can be observed to proceed from the head down the trunk as the infant, on his tummy, first begins to lift his head, then raises up on arms extending the upper trunk, and gradually achieves a fully extended position of "swimming" in prone, or demonstrates a Landau when suspended. This extension enables the child to maintain an erect position against gravity. One sees the cephalo-caudal, or "head to tail," progression as the child gradually achieves more straightening of the trunk in a sitting posture which extends down through the hips as the child comes to standing.

Symmetry begins to emerge in the second to third month of life as the infant brings first his head and then his hands to mid-line and he becomes more oriented around a central body axis. He enters into a phase of bilateral kicking and bimanual reaching. From six months onward, when the symmetrical orientation is well established, he can move out of mid-line as he begins to roll with rotation, pivots and develops uni-manual reaching. But through the counterbalancing and realignment functions of automatic reactions, he always returns to the central body axis. Normal development is symmetrical with no significant discrepancy between rate or quality of development on the two sides of the body.

Independent movement of the extremities refers to the increasing ability of the infant to dissociate the movements of his limbs from the movements and position of his head and trunk, then limb from limb, and finally to isolate individual parts of his extremities. The newborn infant moves almost as a unit. When he is rolled, the whole body moves as a block; he kicks with the total leg; hand movements involve closing or opening all of the fingers simultaneously. Gradually, he achieves more localized control of body parts so that his body can remain supine when his head turns to the side, he can kick with the motion occurring only at his knee with no change in the hip or ankle position, and he can perform movements of individual fingers while the rest of his hand and arm remain stable.

Rotation, separation between the shoulder girdle and hips so that the trunk twists, is an essential element of mature, coordinated motor behavior. It allows mobility in and out of postures, such as vaulting from sitting to quadriped, rolling, and shifting of weight to one side. Rotation is so natural to the normal experience of movement that it is often overlooked when assessing a child's motor patterns. Yet it is frequently lacking in children whose movement has consisted primarily of total flexion or extension or predominant positioning in supine or prone, with little opportunity to move from one position to another. If a child does not show trunk rotation in his movement patterns, it is important to determine by passive manipulation if he has the mobility in his trunk to twist his shoulder girdle apart from his hips.

In a normal child's spontaneous activity, these four components of mature movement are demonstrated repeatedly as the child twists and realigns, bends and straightens, reaches out and returns to mid-line. Yet the most striking characteristic of normal motor behavior is the infinite variety of movements -- not only among different infants but within the same infant who, within a few minutes, will sit in five different postures, progress along the floor on feet, knees, bottom and many combinations thereof, and react with one side of his body as frequently as the other. One child can "pass" an item on a developmental profile several times, performing the skill differently on each trial. This unpredictable quality of response to a motor task not only is seen but should be seen in a normal child, as volitional movement should never be stereotyped behavior.

INTERPRETATION OF MOTOR ASSESSMENT

Interpretation of a child's motor assessment, integrating the observations of tone, reflexes, reactions, and movements into some meaningful understanding, can be organized around two basic questions. The first is: *What can the child do and how does he do it?* With regard to the developmental scale, does the child have a solid performance or is there scatter in his profile with gaps suggesting deficits in particular areas? Does a motor delay correlate with delay in cognitive development, suggesting overall psychomotor retardation, or is the motor impairment restricting advancement of cognitive growth? Are his movement patterns of a normal quality for a younger child (i.e., immature) or is there an aspect to the movement which looks abnormal for any age? Does the child move from one position to another, or does he tend to remain in any posture in which he is placed or falls? Are his movement patterns varied and unpredictable, yet purposeful, or are they repeated stereotyped motions suggesting that the child's repertoire includes only one way to sit, roll, or pull-to-stand? Are his movements characterized by mobility and rotation, or does he move with total patterns in which the limbs move according to the head position? Is movement smooth and synchronous or jerky and uncoordinated? Is he stable or unsteady and fearful of movement?

The second major question is: *What can the child not do and why?* Does he lack sufficient muscle tone to maintain an erect posture or to sustain equilibrium responses of the head and trunk? Does he have excessive muscle tone which is restricting mobility? Are persistent primitive reflexes interfering with a normal response?

Are absent or impaired equilibrium reactions preventing progress toward more advanced skills? Are associated sensory defects present such as tactile hypersensitivity which inhibits manual exploration and weight-bearing on the feet, or visual impairment causing inadequate motivation for an infant to develop head control?

INTERVENTION: FACILITATING INDIVIDUAL GROWTH

With an understanding of a child's developmental strengths and deficits, and suggestions of reasons for the delay or impairment, an intervention program can be designed which not only guides the child toward achievement of more advanced developmental skills but provides him with the necessary prerequisite movement components to do so. The general goals of intervention are: (1) preparation of muscle tone, i.e., giving the child the experience of normal muscle tone to the extent that is possible; (2) inhibition of the reflexes; (3) facilitation of normal automatic reactions; and (4) guidance of active, volitional movements. Specific objectives in pursuit of these goals are determined according to each child's individual assessment. Several good descriptions of infant programs are available which include recommendations for therapeutic activities with distinctive types of children (Connor, Williamson, & Siepp, 1978; Freeman, Gould, & Merkley, 1977). Again, it must be emphasized that therapeutic programs should be designed by a therapist.

One must be cautious of a tendency to program motoric intervention in the same way that adults schedule physical exercise -- one-half hour of jogging or one hour of racquetball -- into an otherwise sedentary life. The most important point in intervention for a young child with a motor deficit is that intervention must be an integral part of the child's full daily life, not a scheduled segment of the day. This is true whether or not a therapist is included in the program. It is disturbing to visit an infant program in which a time-slot in the day's routine is "Gross Motor Period." When observing a normal child up to three years of age, one sees few moments in the day in which the child is not engaged in motor activity, including meals, which usually involve more trunk rotation, symmetrical throwing and banging, and independent mobility than is desired by parent or teacher!

A young child is essentially a motoric being. All of this motor activity provides experience of new patterns of movement, discovery of new feelings of motion and position, and experimentation with new postures requiring more control of the body. Constant repetition develops muscular control, refines the necessary balance reactions, and coordinates movement into the most efficient pattern. Thus, the child is able to build increasingly complex skills on the foundation of more elementary components. If the normal child requires this much time spent in practice and refinement in order to progress to higher levels, it would appear that a child with a neuromuscular impairment would require more time, not less. Yet, too often, one-half hour three times a week of programmed developmental motor experience and stimulation is expected to be sufficient.

In order for a normal pattern of movement to replace an abnormal pattern, the child must first feel -- with tactile, proprioceptive and kinesthetic sensations -- the experience of the normal movement. As this normal movement is repeated it becomes more familiar and the child begins to actively participate in the movement, following or anticipating the facilitator's guidance. Eventually this new movement becomes habit and is incorporated into the child's repertoire of spontaneous motor behavior. This learning process can only occur if the input of normal movement is repeated frequently so that it will have a greater influence on the child than the abnormal, habitual pattern which he uses spontaneously.

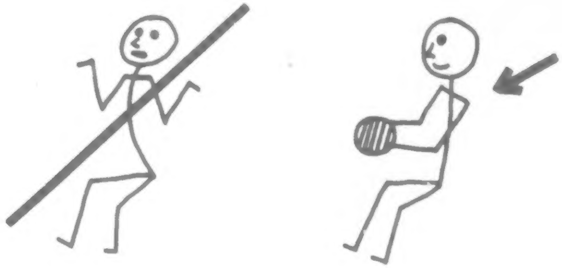
INTERVENTION WITHIN DAILY ACTIVITIES

For this experience to occur with sufficient frequency to produce change, "therapeutic" movements must be incorporated into the positioning, handling, and activity of the child throughout the day. This requires that all persons involved in his care have a thorough understanding of the child's particular problems and the fundamental objectives of handling and positioning. Too often parents and aides are instructed in a technique for carrying a child with no awareness of what this initially awkward way of holding the child is meant to accomplish. Consequently, they cannot be expected to attend to the amount of head control the child is using or the degree of trunk rotation if their only reason for carrying the child in this way is that this is how they have been instructed (often hastily with a squirming child). On the other hand, if parents, aides and volunteers are given a thorough explanation of why certain positions are to be avoided and why particular movement patterns are to be encouraged, they often have the most appropriate methods by which these goals can be accomplished. They generally spend considerably more time with the child than the professional and therefore know best how to avoid irritating the child as well as how to motivate him, and they can usually facilitate new movement patterns in ways which are most comfortable and compatible with the child's own body image. Parents must be included as essential members of any intervention team. In fact, programs which rely on home participation have been demonstrated to be the most effective method of early intervention (Bronfenbrenner, 1975).

As terminology can be technical and abstract, it is helpful to draw sketches -- simple stick figures are sufficient -- for classroom charts and parent notebooks. Illustrations of undesired posture or movement patterns should be included to clarify the problem areas. A red line is drawn through them to demonstrate that this should be discouraged. Next to each "wrong" picture is a sketch of the correct posture or movement pattern, perhaps with arrows to indicate where control must be given to assist the child (see Figure 2). For example, a child who tends to maintain his shoulders in retraction, or pulled back, is pictured in this posture, with a line drawn through it. Beside it is a sketch of a child with shoulders forward, with an arrow suggesting control given at the shoulders. Hands are at mid-line, playing with a toy, demonstrating the functional value of this correction. When they are able to concretely picture the objective, parents or handlers can generalize this desired position to all activities, including feeding, sleeping, carrying, and play (Finnie, 1975).

With this approach to intervention, the child benefits as the normal movement becomes incorporated, both at the psychological

FIGURE 2
ILLUSTRATION OF IMPROPER
AND PROPER POSITIONING



level of his body image and the physiological level of his sensorimotor mechanisms, into all his daily activities. It also provides more incentive and rewards to parents and handlers, who are participating in the child's care in a much more direct, creative, and significant way than they are when carrying out a set of prescribed, routine exercises. This is especially important when considering the stress that can be placed on a parent-child relationship when the parent becomes instructor/therapist (Tyler & Kogan, 1972). Through this daily handling, each of the four general goals of intervention can be accomplished simultaneously in functional movement.

PREPARATION OF MUSCLE TONE

A program of handling should be sensitive to the child's muscle tone at the moment he is being held, since a child's muscle tone can vary greatly according to level of excitation, activity, and general health. With the hypertonic child, positioning and handling are directed at reducing excessive muscle tone. As abnormal muscle tone is generally manifested in characteristic patterns of the limbs and trunk, it is important to know the predominant pattern for each child and to hold and move him in ways which counteract the tonic pattern. For example, the child who tends to be extended will commonly have the neck and shoulders pulled back, extension or arching of the spine and hips, and extension of the legs. To counteract this pattern, the "key points" are hips and shoulders. By bringing the shoulders forward and maintaining the hips in greater than 90 degrees of flexion, the child will generally be in a relaxed state. To help ease the child into this position, pressure can be given on the chest but pressure or touch on the back of the head should be avoided as it stimulates the tendency to push back. For a child who is predominantly flexed, maintaining the arms forward of the shoulders, preventing them from pulling down while maintaining the hips extended and separated, will inhibit hypertonicity.

In handling a hypertonic child, movements should be slow and smooth because stress or anxiety will cause increased muscle tone. The child should be prepared for any active movements by getting him into a relaxed state. Without such preparation, the movement will be on a base of increased tone and the child will learn to associate an abnormal sensation of movement, of effort against restricted mobility, with this activity. The handler should anticipate where a tonic pattern will be manifested and be ready to inhibit a tendency to extend hips or head. By incorporating rotation into a carrying position or a movement pattern, the tendency towards increased tone will be inhibited since rotation involves a combination of flexion and extension and prevents either total pattern.

By contrast, the hypotonic child generally does not show abnormal tonic patterns. However, if stressed or required to balance beyond his capability, he may respond by tensing his muscles in an effort to control his generally floppy body (for example, a hypotonic child who is placed in a standing position but has insufficient control of trunk and hips for this skill). He may lock his knees in extension, retract his shoulders, and extend his lower spine, in other words, stiffen his whole body to remain upright. Since a child in this abnormal posture lacks the mobility necessary for weight shift and balance reactions, this type of stress should be avoided and adequate postural control should be developed in less demanding positions.

INHIBITION OF PRIMITIVE REFLEXES

It is generally understood that a dominant primitive reflex is inhibited by avoiding the stimulus or position activating it, so that it is not reinforced by repeated experience. For example, a child with a persistent ATNR should be positioned primarily with his head in mid-line, since the reflex posture is stimulated by head turning to the side. A child with a strong positive support reflex should not stand or bounce on extended legs, whether held, placed in a jumper or walker, or pulling himself to stand at furniture.

It is also important to recognize that in normal development a primitive reflex becomes extinguished as the child gains active, volitional control in developmental activities which counteract the reflex. The ATNR is diminished as the child assumes a mid-line orientation. He brings the hands to mid-line in a directed purposeful movement in which the arms move independently of the head. Later the child uses this same independent movement to bring his hand to his mouth while his head is turned to the side, overcoming the ATNR posture. Similarly, the Moro reflex becomes less apparent as the child gains active head and trunk control in the sitting position.

Rather than focusing on working against primitive reflex activity then, intervention should emphasize development of the volitional skills which overcome the reflex, beginning in a position which does not itself elicit the reflex. For example, the tonic labyrinthine reflex increases extension when the child is in supine position, preventing him from bringing his hands to mid-line or raising his feet to his hands. These volitional skills can be encouraged in other positions, such as side-lying, in which the tonic labyrinthine reflex is not stimulated. When volitional control is achieved in side-lying, the child can gradually be eased into supine where the active skill can eventually overpower the pull of the reflex. Similarly, weight-bearing through relaxed legs on flat feet should be introduced in a squat position or sitting astride a lap or roll with hips and knees flexed to inhibit the influence of positive support. As the child develops the ability to maintain this posture, the legs can gradually be extended.

FACILITATION OF AUTOMATIC REACTIONS

Automatic reactions are facilitated by moving the child in such a way that his body will unconsciously adjust to the changes of posture and shifts in the center of gravity. They can be facilitated in all positions and can range from a few degrees of head control to subtle balance responses of the feet in standing. As balance is an integral part of all movement, it is easily incorporated into handling of the child. It is the difference between carrying a child with full support at his head or allowing the head to be free so the child develops his own head control. Similarly, lifting the child by picking him straight up from the floor generally involves no activity on the child's part. By rotating his upper trunk to side-lying and then bringing him slowly to sitting, body rotation, head righting, equilibrium reactions of the trunk and protective extension of the extremities are all encouraged. By rolling a child from supine to prone by flexing one leg across the body and waiting for him to complete the movement, head righting, body derotation, and trunk equilibrium are facilitated. If this simple activity were done every time the child was diapered, dressed, or his position was changed, it would have a visible effect on his motor development.

Automatic reactions can only occur when the muscle tone is sufficient for mobility and postural control. On this foundation, the child must first experience the normal pattern of postural adjustment and then must be allowed to actively perform the response. It is necessary to gradually withdraw the support given to the child so that he can exercise active, independent control. However, if he becomes insecure or is pushed beyond his capacity to respond, there will likely be increased muscle tone and/or the reaction will be in an abnormal movement pattern. Movements of tipping the child and rotation of the body, therefore, should be done slowly so that the child does not become fearful and to allow time for him to recover his equilibrium, since the response may be delayed.

GUIDANCE OF VOLITIONAL SKILLS

Preparation of muscle tone, inhibition of reflexes, and facilitation of automatic reactions allow the child to initiate purposeful, volitional skills. If appropriate motivation to move is present and the underlying neuromuscular foundation for movement has been established, the child will "facilitate" his own intentional activities spontaneously. The role of the handler is to guide the motion to insure that it is accomplished with a normal movement pattern and without increased tone. As a motor skill is not learned by passive experience, it is essential that the child actively perform the movement to the extent possible. Because a child with a motor impairment is frequently inclined to remain in one position, guidance in and out of postures (such as sitting to quadriped or rolling prone to supine) is necessary intervention. Considering the number of times in a day when a child is passively moved, lifted, and turned, these activities need not be practiced as a specific regimen. By moving the child slowly through each position change, leading him in an active movement rather than manipulating him passively, therapeutic intervention is accomplished throughout the day.

In all functional skills it is necessary to know the essential subordinate movements which are involved in performing that skill. Where they are lacking or impaired, these prerequisite movements should be prepared at more elementary levels of function so emphasis can be placed on developing them within an activity which is less strenuous for the child. Consider the child who is not yet creeping because he is not taking weight on his hands. If attempts are made to develop this ability in a quadriped position, he is likely to collapse on his arms. The capacity to take weight on the arms should first be mastered at a more primitive stage in prone, on the floor or over a wedge or bolster. From the prone position, the child can progress to weight-bearing on hands in sitting, with arms in front or rotated to one side. As the child maintains the support he can gradually be taken into more of a quadriped position so he takes increasing weight through his hands.

FUNCTION OF MOVEMENT

Finally, it is important to consider movement in young children as more than a mechanical process to be analyzed and, if necessary, assisted in the developmentally delayed or disabled child. The ultimate function of movement to the child is a vehicle for learning. Piaget (1952) has emphasized that cognitive development requires encounters with new environmental events, situations, and objects which require the child to develop new behaviors to respond to these environmental challenges. Learning happens as a result of direct interaction with the environment rather than passive observation. This interaction through exploration and manipulation is dependent upon the ability to move. Consequently, in the child with motor impairment, the opportunities for cognitive learning may be limited. The process of motor assessment and intervention is not an end in itself, but should be directed at promoting this active experience of a changing, intriguing environment which can be modified in reliable ways by the child's own motor behavior.

Numerous infant curricula give suggestions for enhancing tactile, vestibular, and kinesthetic stimulation directed at an impaired child. It is perhaps more important, however, to consider the need of the child to influence the environment. This need is realized in two modes of movement.

First, to explore the surrounding world requires a means of locomotion: the ability to move from one place to another. An older child or adult may be able to function adaptively and learn while immobilized in a chair. However, in the young child, learning about spatial relationships, perspective, body awareness, and the diversity of the environment comes from purposeful excursions into the world with the whole being. Therefore, providing a means of mobility is a priority for intervention efforts in motor behavior. Rolling is often the only means of independent mobility available to a child. By facilitating rolling when moving the child from place to place within the schoolroom or home, he can begin to associate this form of movement with progression over distance. Because of the effort involved in any form of locomotion, movements which exaggerate muscle tone abnormalities should be avoided and alternative, functional activities investigated. Crawligators, scooter boards, and in some cases walkers, may be effective aids for various children, often with modifications to insure proper positioning and support. Finding a suitable means of locomotion for a child may require a significant investment of time and ingenuity but should be a high priority in a child's program.

A child's primary means of manipulating his environment is play. Through play with objects, the child expands his knowledge of texture, size, shape, and functions of objects, and the relationship between himself and objects. Because this is an essential part of learning about the environment, a child must be given appropriate objects with which to play. A toy can be either rewarding or frustrating to any child. For a handicapped child, there may be few objects which can offer him satisfying experiences with an opportunity to learn and develop self-confidence in his encounters with the external world. It is no less important for parents to observe their child engaged in enjoyable play and for them to feel that they can provide their child with this significant childhood activity. Too often, children with motor impairments are given toys which merely entertain, in the belief that they are unable to play with toys which require manipulation.

Toys should be selected carefully, with attention to a child's skill level, his muscle tone and movement patterns, and his personal preferences. A teacher can often help parents make this decision. For a hypertonic child, toys which involve grasping and pulling tend to exaggerate muscle tone. Therefore, recommended toys and games are those which emphasize knocking or batting, pushing, or smearing with open hands. For a child who is hypotonic or lacks stability of movement, heavy solid toys can provide a point of fixation around which he can organize his activity. Large toys that require bimanual grasp can facilitate mid-line orientation and symmetrical orientation. A loud toy or surprise box may not be appropriate for a child with a Moro or startle reaction.

The placement of play materials in relation to the child should be considered with respect to the child's abilities, movement patterns, and needs. A bare surface on which toys will clatter will cause a child to become disoriented. A toy held or placed above a child's head can encourage hyperextension of the neck, triggering extension throughout the body. It is particularly important that the child be positioned with a secure base of support so that he is not required to work at balance. The head should be stable so that the eyes and hands can be coordinated in functional visual-motor activity. These are only a few, very general suggestions; the needs of each child, of course, differ. Again, parents who clearly understand their child's motor problems and objectives demonstrate marvelous creativity in devising play materials and games.

The analysis of motor development presented in this chapter has led from the physiological properties of muscles to intellectual learning in the young child. This reflects the close association observed by psychologists between a one-year-old's play behavior, in which he physically combines two toys, and the simultaneously developing cognitive ability to relate two objects or events in cause-and-effect or means-ends relationships (Fenson, Kagan, Kearsley, & Zelaza, 1976). Muscle tone, palmar grasp reflex, head control, and mid-line orientation -- all involved in the simple act of reaching for and combining two objects -- assume new significance when considered in light of their role in cognitive growth. In the handicapped infant, therefore, it is necessary for the educator, parent and therapist to understand the fundamental elements of movement in order to bring the child and his toys together in meaningful play.

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INFANT COGNITION:
CONSIDERATIONS FOR ASSESSMENT TOOLS

Betty L. Darby

The term "cognition" has traditionally been used to refer to symbolic and representational thought processes that are not necessarily dependent upon immediate perceptual input. Since predictable and organized behavior in early infancy does appear to be dependent upon immediate perceptual input, it has been questioned whether infants can be considered to function cognitively by this definition. Among researchers working with infants, early cognition is considered to consist of sensorimotor-bound activity. In other words, early infant cognitive functioning occurs in the form of motor patterns, rather than in the form of purely mental or symbolic activity.

Cognition cannot be directly observed or measured, but is inferred from the behavior of an individual within a specified context. Changes in behavior in similar contexts over time are assumed to reflect changes in cognitive functioning and/or structuring. For example, when an object that a seven-month-old has shown interest in is completely hidden under a cloth, the infant may not search for it, even though it can be demonstrated that he has the motor ability to lift the cloth. Several months later, this same infant will actively search for an object hidden in this way. From the change in behavior in the same situation, it is inferred that the cognitive structures of the infant have changed so that he is able to conceive of finding objects that are not immediately visible.

In order to infer cognitive structuring from observable behavior, and in order to be able to assess the "normality" of cognitive functioning, it is helpful to have a theoretical framework. The Piagetian sensorimotor period provides such a framework (Ginsburg & Opper, 1969; Piaget, 1954). The six stages described by Piaget provide descriptions of those behaviors that are believed to reflect specific cognitive structures, in addition to describing a developmental sequence of changes in cognitive functioning. Although the sequence of changes in cognitive functioning during the sensorimotor period is considered to be invariant (as a function of the typical biology of the human infant and the environment available to humans), the rate of development through the sequence may be environmentally influenced (Uzgiris & Hunt, 1975).

In the Piagetian framework, cognitive development is assumed to begin with primitive reflexes such as sucking and grasping. As a result of repeated interactions with the environment, these early motor patterns (or schemes) are altered. The development of the schemes is a function of two reciprocal processes, assimilation and accommodation. At first, an infant attempts to fit all environmental stimuli into already existing schemes. For instance, he will tightly grasp anything put in his hand and will suck on any object put in his mouth (i.e., he assimilates the objects into his grasping and sucking schemes). However, as a result of differences in the objects he grasps or sucks, the infant will accommodate his schemes to better conform to the characteristics of the specific object with which he is interacting. For example, various nipples require differing types of sucking styles in order to facilitate the flow of fluid. Infants quickly change their existing sucking schemes to accommodate to the characteristics of a specific nipple.

While the first two sensorimotor stages deal with elementary sensorimotor adaptations, progressing from reflexive behavior to gradual modification and differentiation of the reflexes, the next four stages deal increasingly with intentional sensorimotor adaptations. Stage 3 is characterized by an infant's attempts to prolong or repeat an act that has produced an interesting event. During Stage 4, an infant actively anticipates goals, and actions aimed at producing interesting events become less generalized and more directed. Stage 5 is characterized by an active search for new means through the differentiation of existing schemes (i.e., overt trial-and-error problem solving is predominant). Stage 6 involves the development of primitive forms of representations. This stage is sometimes considered to be the beginning of true symbolic cognition. The infant is now able to solve problems without necessarily going through overt trial-and-error strategies. Each stage is believed to involve a reorganization of the preceding stage.

ASSESSMENT OF COGNITION

Early attempts to assess infant intelligence were based on the premise of an unitary function, called g, which subsumed all intellectual activity (Lewis, 1976). This factor was assumed to be consistent over time and to be easily measured by looking at performance on items requiring mental activity. However, the consistent failure of infant test scores to predict later childhood test scores resulted in the rejection of this unitary factor model of mental development. In its place arose various multi-factor models: "Infant intelligence is not a general unitary trait but is rather a composite of skills and abilities that do not necessarily co-vary" (Lewis, 1976, p. 14).

Today, it is generally accepted that a number of skill areas need to be considered in order to adequately assess an infant's cognitive functioning (e.g., object permanence, verbal and gestural imitation). In addition, it appears impossible to obtain an assessment of cognitive functioning without also requiring the infant to make use of motor, social, and communicative skills.

Instruments used to assess cognitive functioning are, for the most part, based on one of two approaches--the traditional psychometric methodology or the more recently available methodology based on development theory. Examining an instrument based on each of these approaches allows a comparison of their usefulness for each of the three major functions of infant tests: (1) an assessment of current functioning; (2) detection of delayed or abnormal functioning (in order to design an intervention program); and (3) evaluation of the effectiveness of intervention.

The Bayley Scales of Infant Development (Bayley, 1969) provided the first well standardized test of infant mental development. The scales were developed in the psychometric tradition, which means that the items were empirically selected according to their ability to show an increase in percentage of passes with increasing age. Efforts were made to emphasize individual differences. Three other criteria used in item selection were apparent relevance for adaptive functioning, internal consistency of the items, and interest value of infants. The mental scale currently consists of 163 items which are ordered by level of difficulty. These items measure responses to visual and auditory stimuli, manipulation and play with objects, responses involving social interaction (e.g., imitation), object constancy, simple problem solving, shape discrimination, and receptive and expression language. Each infant is given only that portion of the scale appropriate for his age. The raw score is a function of the total number of items passed and does not give any information about specific items that were passed and failed. The raw score is converted to a normalized standard score (Mental Development Index or MDI) which represents how an individual infant compares to his age-mates in the standardization sample. Although handicapped infants were excluded from the standardization sample, it is possible to determine an "age equivalent" for an infant functioning below his or her age-mates. An "age equivalent" is an estimate of the effective level of functioning demonstrated. For instance, a 17-month-old achieving a raw score of 110 on the mental scale is demonstrating a level of functioning similar to that of the average 14-month-old child.

Numerous studies have been conducted to assess the reliability and validity of the Bayley scales. Although test-retest and internal consistency reliabilities are generally found to be adequate, satisfactory levels have not consistently been reported for the predictive validity of the scale. Efforts to investigate how well early individual differences during infancy predict later measures of intelligence (e.g., IQ scores) have resulted in the conclusion that, for normal infants, test scores have little predictive validity (Lewis, 1976; McCall, Hogarty, & Hurlburt, 1972; Stott & Ball, 1965; Thomas, 1970). Among the reasons postulated to account for this lack of predictive validity are: the high variability in the rate of normal development, qualitative changes in mental functioning between infancy and childhood, and insufficient sophistication of the Bayley (or infant tests in general). Although correlations over long developmental periods are small, it has been found that testing at shorter intervals results in moderately strong correlations (Lewis, 1976). It should also be noted that predictive validity has been reported to be higher for low-scoring infants or for "normal" infants when information other than isolated test scores are considered (Brooks & Weinraub, 1976; Honzik, 1976; McCall, Hogarty, & Hurlburt, 1972; Ramey, Campbell, & Nicholson, 1973).

As mentioned earlier, the Bayley MDI does provide a means for comparing one infant's performance with that of other infants of the same age in the standardization sample. In other words, it provides information about an infant's current mental functioning. The Bayley can therefore be used to detect those infants who are currently functioning significantly below their chronological age-mates. However, performance on the scale does not, in itself, provide sufficient information for programming interventions. With a thorough knowledge of normal developmental sequences, it is possible to pinpoint those areas of functioning that appear delayed according to the test performance. However, the test items for any one concept area are usually insufficient in number to allow an examiner to know exactly where to target intervention efforts. For instance, looking at the sequence of behaviors coded as being manipulative (Figure 1), consider the infant who bangs objects in play but does not transfer them from hand to hand.

FIGURE 1
SEQUENCE OF MANIPULATIVE ITEMS
FROM BAYLEY MENTAL SCALE (1969)

Item No.	Description of Item
43.	Manipulates the table edge slightly
50.	Manipulates table edge actively
66.	Bangs in play
69.	Transfers object hand to hand
72.	Interest in sound production

It cannot be assumed that the next skill the infant should attain is transferring, because these items were chosen empirically and thus do not represent a logical sequencing of skills. There may be numerous skills that must be acquired between the ability to bang and the ability to transfer, in which case efforts to teach the infant to transfer may not be fruitful.

The usefulness of the Bayley in evaluating the effectiveness of early intervention depends on the focus of the intervention. If the aim is to "normalize" the child or to optimize overall functioning, then the use of this psychometric test can provide data on program effectiveness. However, many professionals working with infants have expressed reservations about using standardized developmental assessment tests such as the Bayley to evaluate specific interventions (Lewis, 1976). An infant's score on the Bayley following a specific intervention program (e.g., expressive language program) would not necessarily detect the real gains that the infant may have made, unless the skill gains happened to coincide with a number of Bayley items.

Unlike the Bayley, the Uzgiris-Hunt Ordinal Scales of Psychological Development (Uzgiris & Hunt, 1975) were not developed in the psychometric tradition. These scales, based on Piagetian theory, were originally developed to assess the influences of differing environments on early development. Test items were selected so as to represent an ordinal sequencing of cognitive development within each of six major concept areas:

1. Object concept (visual pursuit and object permanence)
2. Means-ends relationships
3. Imitation (vocal and gestural)

4. Operational causality
5. Construction of object relations in space
6. Development of schemes for relating to objects

Visual pursuit and visually directed reaching have been identified as important to the development of each of these concept areas (Cohen & Gross, 1979). The order of items within each concept branch is based primarily on logical implication (i.e., one skill necessarily preceding another), which Uzgiris and Hunt believe to result in a largely invariant sequence. This invariant ordering means that an infant should pass all items up to a certain point and then consistently fail all items past that point.

Although the scales are based on Piagetian theory, they are not designed to assign an infant to a specific sensorimotor stage. Rather, they are designed to describe the level of organization demonstrated by an infant in each of the six branches of psychological development. The scales are not currently standardized, and Uzgiris and Hunt (1975) state that they never had any intention of doing so since they believe that the various levels of organization tapped by the scales have psychological significance in their own right and stand by themselves. The infants assessed during the development of the scales were all children of University staff and faculty--clearly not representative of the general population. As was true for the Bayley, handicapped infants were not included in the samples.

Uzgiris and Hunt (1975) report test-retest stability to be satisfactory, usually being well above 70 percent. Due to their recent advent, little has been reported concerning the predictive validity of the scales. Uzgiris states that there is no clear conceptual reason to expect a child's level of organization during infancy to correlate with later IQ scores (Lewis, 1976). However, there is evidence of a relationship between performance on the Uzgiris-Hunt (12-24 months) and Stanford-Binet performance at 31 months (Wachs, 1975).

Infant performances on the Ordinal Scales do provide a measure of current cognitive functioning. But since there are no norms available, it is difficult to use the scales to determine if a particular infant is functioning significantly below his or her age-mates. In terms of detecting abnormal development, it is possible to look for extreme differences in rates of development in all six branches. Although Uzgiris and Hunt state that the six branches develop relatively independently of one another, it is obvious that some skills in one branch are necessary for further development in another branch. For example, unless an infant is capable of visually directed reach (step 2 of Scale II: the development of means for obtaining desired environmental events), he will not be able to achieve steps in Scales I-IV which require this skill.

I find one of the most useful aspects of the Uzgiris-Hunt scales to be their ordinal nature. While Uzgiris and Hunt do not claim to have included every step relevant to development in each branch, a child's performance on the scales does suggest what the next skill acquisition should logically be. The data obtained from these scales are well suited for designing an intervention program. The developmental sequence of cognitive functioning provided by Cohen and Gross (1979) is based largely on the Uzgiris-Hunt scales and suggests that programming should focus on breadth of experience at each step rather than focusing solely on progression to the next step.

The usefulness of the Ordinal Scales of Psychological Development in evaluating the effectiveness of a specific intervention program depends on the focus of the intervention. If a specific intervention involves one of the six psychological branches, it is possible to use these scales to assess intervention effectiveness. To further sensitize the scales to child changes as a result of intervention, it is possible to make a task analysis of each step before programming begins. This allows one to examine infant performance during, as well as following, the intervention.

EVALUATION OF COGNITIVE INTERVENTION PROGRAMS

A standardized psychometric test, such as the Bayley, may be used in one of two ways to evaluate effectiveness of intervention. An infant's score can be compared to those of the normal infants in the standardization sample or an infant's gain in score from pre- to posttest can be evaluated. With moderately delayed or retarded infants, it is unlikely that these types of data would provide the information needed to judge the effectiveness of a specific intervention. The Bayley was not designed to provide this sort of information.

Tests based on a theoretical framework, such as the Uzgiris-Hunt, provide a measure of the effectiveness of the intervention in enabling the infant to acquire the next skill as part of a logical sequence. However, those steps are not equally spaced, so it is not possible to simply examine the total number of steps passed because some steps take longer to acquire. This difficulty may be partially alleviated by breaking the steps down (via task analysis) and measuring the infant's acquisition of the components of each step. Since Uzgiris and Hunt believe that development in the six branches proceeds relatively independently, it is also possible to use a multiple baseline procedure to assess the effect of an intervention focused on development in one of the branches. For example, baseline data (before intervention begins) may be obtained on the infant functioning in two areas: the one to be the focus of intervention (e.g., object permanence) and another that is not going to be specifically focused upon (e.g., vocal imitation). If intervention is effective in promoting skill development, then infant performance in the object permanence scale should reveal pre- to posttest gains, while such gains would not be expected in vocal imitation. However, to the extent that a number of the same items appear in several different scales, the independence of the branches is in question, violating the assumption of the multiple baseline procedure.

SUMMARY

Although a psychometric tool is useful for detecting infants who are functioning mentally below their age-mates, those currently available are less useful for programming and/or assessing the effects of intervention. A nonstandardized assessment tool based on logical implication may be of limited usefulness in detecting low-functioning infants, but also may have practical applications for programming and evaluating intervention. At this point in the development of infant intervention, it appears advisable to collect a number of different types of data in order to assess program effectiveness. Documenting the entry level of infants via standardized tests, and then documenting change during and following intervention using developmental sequences, are most likely to result in the data needed to evaluate various infant intervention programs.

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COMMUNICATION DEVELOPMENT, ASSESSMENT, AND INTERVENTION

Nancy Nichols

Communication development in the birth to 3-year-old child is an extremely broad and comprehensive area. At this time, there is a vast amount of research being done in the area of communication and language development in infants. Therefore, it would be impossible to cover all the information currently available. I will, however, cover three specific areas and share with you some of the recent research being done, as well as some of my own feelings and experiences in the areas.

The three areas to be covered are: (1) the sequence of communication/language development; (2) assessment of communication/language development; and (3) communication programming and intervention strategies.

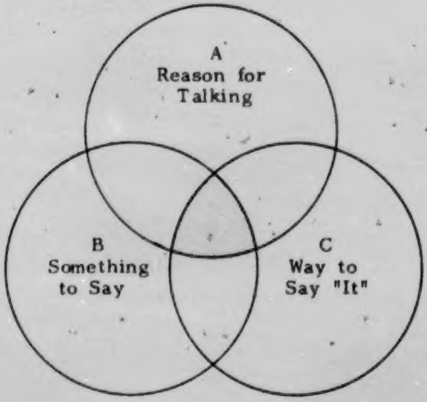
Before continuing, let me define communication, language and speech, since there are various definitions used for these words in different contexts. For my purposes, communication refers to the nonverbal and verbal exchanges of ideas, information, and feelings in interactions between two or more people (Lynch, 1978). Language is a rule-governed symbol system through which we communicate meaning to others in our environment. That is, one can communicate without language, but it is language that allows the representation of experiences to be shared with and understood by others in the same linguistic community. This representation usually takes the form of spoken symbols or words. Finally, speech is best defined as the actual articulation of sounds and sound combinations used in the verbal language system (Miller, 1974).

SEQUENCE OF COMMUNICATION/LANGUAGE DEVELOPMENT

The development of communication and language behaviors has generally been divided into two major skill areas: production or expressive behaviors and comprehension or receptive behaviors. These are then arranged chronologically as sequences of development. There are many developmental sequences available, ranging from those containing a small sample of behaviors in the sequence to those that contain a large sample of behaviors. Miller (1974) has pointed out that such sequences or scales are only as good as the behaviors sampled and how well these behaviors sampled can be used to discriminate different developmental levels. In order to determine whether or not a particular developmental scale would be useful, it is necessary to determine why you want to use such a scale and what kind of information you intend to receive. Once these two questions have been answered, you should be able to pick an appropriate scale for your specific needs. Some of the more widely used developmental scales include the Learning Accomplishment Profile (LAP), the Portage Project Checklist, and Developmental Pinpoints.

Historically, communication/language development has been divided into two major areas: content (semantics) and form (syntax). Content or semantics refers to the meaning we convey with the various linguistic tools. Form or syntax refers to the sounds, words and grammatical structures used to convey the meaning of language. However, recent researchers have added a third area to language development, that being the motivation or a reason for developing language. Coggins presented a diagram (Figure 1) to represent these three areas in a presentation on communicative disorders in children (University of Washington, March 7, 1979).

FIGURE 1
THREE MAJOR AREAS OF
COMMUNICATION/LANGUAGE DEVELOPMENT



Source: Presentation by T. Coggins, Child Development and Mental Retardation Center, University of Washington, March 7, 1979.

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The earliest researchers in language development focused on C, syntax--how things are said to others, how words go together and what the rules are for these processes. Coggins and Carpenter (1979) provide an excellent developmental sequence, which chronologically presents various researchers' findings in the production and comprehension of grammatical form. This includes sentence elaboration (using articles and various verb forms), inflectional development, interrogative sentence and negative sentence development. The majority of development in these areas takes place after three years of age. However, the sequences described do provide an overall view of a child's syntactical development which could be kept in mind for his long range goals or objectives.

Around 1970, there was a shift in focus from the form of language to the content of language (Coggins & Carpenter, 1979). Bloom was one of the primary researchers in the area of semantics. Having "something to say" (shown in circle B) represents the semantical aspect of language. Bloom has described two types of meaning, referential and relational. Referential meaning refers to child's lexicon, or vocabulary, whereas relational meaning refers to the meaning between two words. (Word order and how the words are combined in phrases and later in sentences is the basis of relational meaning.) For example, if you said "boy-cookie-eat," it is more difficult to infer meaning than when "boy-eat-cookie" are combined to give meaning to those words. These two areas of meaning have been outlined chronologically by Coggins and Carpenter (1979).

The research being done in the area of semantics (i.e., referential and relational meaning) indicates that meaning in a child's words proceeds in a developmental fashion and is related to context. Beginning with the utterance of a child's first word at approximately 12 months, much of what a child means must be interpreted in relation to the context in which the word is used. A single word may signify different things at different times. For example, the word "cat" could be a request for the cat or a simple naming exercise. As the child begins to combine two and three words together, the need for context becomes less essential, whereas the need for relational meaning becomes critical if the child is to communicate with others in his linguistic environment.

Bates (1975) presented the contention that a child has what she calls "communicative intentions." These "communicative intentions" must be present or there will be no reason for developing a language system (Coggins & Carpenter, 1979). In other words, communicative intentions are considered to be prerequisite to language development. This requirement of communication/language development is represented in circle A of Figure 1. These intentions are generally indexed by the preverbal gestures and vocalizations a child uses to convey meaning. A child under 12 months is able to request, protest, comment, greet, transfer, show off, acknowledge and answer without using words. A more detailed description of each of these categories is included in Appendix 1. As was the case in early word usage, the context in which the intention is "spoken" is extremely important. The child cannot communicate as efficiently with communicative intentions as he can with words. Bates (1976) believes that the vocalizations that accompany the gestures of the communicative intentions evolve into words and the words into sentences. This process allows the child to become a communicatively competent speaker (see shaded area in Figure 1).

Current research supports the hypothesis that language acquisition is predicted on a child's general level of cognitive functioning. Ferreiro and Sinclair (1971) state that it is probable that there are certain cognitive notions that precede the acquisition of particular semantic and grammatical forms.

Piaget believes that the development of intelligence is based on the child's active exploration of objects and people. This active exploration and manipulation allows a child to learn about an object's characteristics and functions. This period is called the sensorimotor period and generally ends around two years, when the child develops the ability to mentally represent objects and events that he has previously experienced directly. Piaget describes six stages of development in the sensorimotor period. A more detailed discussion of the sensorimotor period is available elsewhere (Uzgiris & Hunt, 1975). A list of some specific behaviors observed during each stage is included in Appendix 2. In terms of the prerequisites to developing language, the latter three stages are most relevant.

For example, one such prerequisite would be a child's development of understanding means-ends relationships, that is, the methods used to obtain some goal he desires. The development generally proceeds as follows: by 12 months a child uses specific and familiar behaviors to achieve his goals, an 18-month-old child is inventing new means to achieve his goals in a trial-and-error fashion, whereas a 24-month-old child no longer uses trial and error, but mentally thinks through various means and chooses the most direct and efficient behavior to achieve his goals.

Applying this to language development, it is apparent that words and later sentences are more efficient and expedient means for obtaining ends than are the earlier means such as looking, pointing and vocalizing. Thus a child's language development seems to be dependent upon the development of these basic cognitive behaviors during the sensorimotor period.

As a child develops, he is learning by actively interacting with the objects in his environment. As he interacts with a wide variety of objects and people, he begins to internalize his experiences and is able to represent his actions and the objects mentally. Mental representation may take the form of various images or symbols or words. At this point, the child begins to have language. He is motivated to say something, he has something to say, and he is beginning to learn how to say it.

ASSESSMENT OF COMMUNICATION/LANGUAGE DEVELOPMENT

Miller (1974) presents three questions that must be answered prior to assessing a child's communication/language behavior: Why are you assessing the child? What are you going to assess? and How are you going to assess? By answering these three questions, one is able to define the goals, content, and method of assessment most appropriate for each child.

There are four major reasons for assessing a child: (1) to determine his present level of functioning; (2) to document the existence of a developmental delay in his language development; (3) to describe the nature of the developmental problem; and (4) to be able to measure developmental change once intervention has begun. Answering the first three questions allows a teacher to formulate an intervention strategy aimed at an individual child's development. The fourth aspect provides documentation of the impact of the selected intervention strategies.

What will be assessed depends on the child's age and his presenting problems if any (e.g., cerebral palsy, cleft palate). Each of these factors may affect what we assess as well as how we are assessing each child. Referring to Figure 1, there are three areas in language development that will need assessment: (1) communicative intentions and cognitive prerequisites; (2) semantics or what a child means; and (3) syntax, including phonology or how a child says something and the rules he must apply to what he says.

How we will assess each child is intricately tied to why and what we are assessing. Generally, we can use any one or a combination of the following procedures: standardized tests, nonstandardized tests, and developmental scales. Rather than discussing each of these procedures, I am going to describe four assessment tools currently being used to assess infants in communication/language development. I will not elaborate on developmental scales since examples of some of the more common scales were cited earlier in this chapter.

Assessment of an infant's communication or language development must begin by assessing his current cognitive level of functioning. This is particularly important when considering a developmentally delayed child. As reported earlier, there seem to be certain cognitive prerequisites to language development in children. Therefore, in order to find out where a child is in his language development, we must assess his cognitive behaviors. There are several tools used to assess cognitive development. The Uzgiris and Hunt Scales (1975) are probably one of the better measures to date. At present, there are no assessment tools for looking at communicative intentions, although Coggins and Carpenter at the University of Washington are currently looking at ways to operationalize and observe these behaviors in children. They observe children and attempt to code their communicative intentions. One outcome of this research may be to assist teachers in determining where to focus intervention programs with communicatively delayed children.

Once cognitive skills have been assessed, more specific communication and/or language skill levels need to be considered. This may be done by using standardized measures or nonstandardized measures.

There are very few standardized procedures appropriate for children functioning below three years of age. One tool, the Sequenced Inventory of Communication Development (SICD) (Hedrick, Prather, & Tobin, 1975), was developed to assess communication skills in children from 4 months to 4 years. The SICD was standardized on 252 normal children across this age range. The test has receptive and expressive scales and yields a functioning age level in each. The SICD is currently being used by communication disorders specialists at the University of Washington as a pre- and post-measure of child growth as well as to establish program goals and objectives for children who exhibit language delays.

Whereas a standardized measure has established procedures for administration and scoring, it is at best only an indirect comparison with your population. A nonstandardized test allows for flexibility in application and can be modified for individual children (e.g., can be done at home or school, items can be changed to fit a child's particular needs, etc.).

Two of the nonstandardized instruments available are overall assessment tools with strong cognitive and language sections included. Developmental Programming for Infants and Young Children (Schafer and Moersch, 1977) was developed to provide teachers and therapists with a tool that would assess a child in terms of his developmental levels and assist teachers in developing short-term behavioral objectives for programmatic purposes. It is intended to supplement standard psychological, motor and language evaluation information. There are three manuals to this assessment, including an instruction manual, an individual assessment booklet and a book containing a collection of sequenced activities that can be used for specific objectives. The entire test can be given by one staff member but the authors recommend that the tester be familiar with administration, scoring and interpretation procedures so as to insure that the child's performance is a valid estimate of his current level of functioning.

The second nonstandardized instrument, the Infant Learning Program's Behavior Repertoire for Handicapped Infants (Adams, Chandler, Freedman, Gentry, Livingston, Robinson, Soltman, Stade, & VanderVeer, 1977), is a developmental sequence being used in programs at the University of Washington. At this time, it is used by teachers to determine specific developmental levels of children functioning in the birth to 12-month age range. Following assessment, the teacher writes specific programs for the child in each area. These include gross and fine motor, language, cognitive and social/self-help skills. The scale does not result in a developmental score per se, as does the Developmental Program and the SICD, but it does give a behavioral description of the behaviors to be observed and how the teacher is to test the infant on each item. The weaknesses of this instrument are that it does not presently extend beyond the 12-month level, and that there are no standard criteria for pass-fail on the items (e.g., how many times to present each stimulus or how long a behavior should be observed). The Infant Learning Program's instrument does not list specific activities, which encourages teachers to plan creative and innovative programs aimed at reaching each child's particular objectives.

Applications

The preceding tools are examples of some of the assessment tools currently used to assess communication and language development. In order to determine which type of tool is best for assessing your particular children, analyze why and what you want to assess in order to determine as specifically as possible what kind of tool you need. Once that has been done you're ready to review the variety of tools and select the one most appropriate for your needs.

COMMUNICATION PROGRAMMING AND INTERVENTION STRATEGIES

After you have completed the assessment of a child's communication or language skills, you will have determined his developmental skill level and you can describe and specify the behaviors or skills needing remediation or intervention. At this point, you are ready to develop a communication or language program based on the results of your assessment procedures. There are approximately eight components involved in writing or setting up a particular program. As outlined by Stremel-Campbell (1977), these are:

1. Stated objective and task analysis of the objective
2. Description of the training environment
3. Strategies and techniques involved
4. Materials to be used
5. Child behavior
6. Criteria for change
7. Date program was initiated/ended
8. Trials to criteria

Although there are a variety of formats used for writing program plans, most include these eight components. Appendix 3 includes an example that elaborates on the components. They represent the process involved in preparing a program and are important when we are devising, implementing and evaluating a child's communication programs. However, the process will be beneficial only if the content of the program is related to or aimed at achieving the particular skill/objective we are working toward.

At present there is no one curriculum that provides all the answers on how to plan the content of communication programs for infants. Instead, there are a variety of texts, published curricula, and other resources that offer a variety of activities aimed at achieving specific goals or objectives. These vary in theoretical basis (e.g., developmental or behavioral). Some outline very discrete steps to be taken in each activity; others offer only vague descriptions of the activities. As with assessment tools, one must define needs and go with appropriate materials. At present, many teachers and other interventionists pull programming ideas from the wide range and variety of materials available. This allows room for creativity and experimentation within this area of infant programming. Selected references for communication or language programs for infants are included at the end of this chapter.

As a teacher of developmentally delayed infants and preschoolers, I feel that programming in the cognitive, communication, and social/play skills domains is one of the highest priorities in a child's intervention plan. At times, the skills in each of these overlap; thus, a program for a communication target may also be facilitating a play skill in the infant. This overlapping is important to keep in mind when writing programs for children.

The Stremel-Campbell format (Appendix 3) described earlier is usually written very specifically and carried out daily if possible. In terms of skill development, the objective in that written program is the next behavior that child needs. This type of program can be done on an individual basis or with a group of children, although the structure remains intact and the step-by-step procedures are followed as they are written in the program. This type of program lends itself to a behavioral approach to systematic language training. Language training starts by training a child to attend to and then imitate gestures and verbalizations. Once the child is proficient in these skills, teachers move on to such targets as taking a named object, pointing to a picture of the named object, and naming an object the teacher shows.

In addition to this structured approach to language training or programming, teachers can also facilitate specific objectives continuously throughout daily classroom activities. This approach is extremely functional when working on communication and language skills. The teacher can facilitate specific targeted behaviors in an ongoing, natural fashion and incorporate constant generalization of various skills into the child's classroom activities. For example, a child is playing on the floor near another child who has a ball. The child looks at the ball and points. The teacher observes this and wants the child to be using approximate sounds to single words, so she says to the child, "Say ball." The child responds by making a "ba" sound so she immediately gives the child the ball, perhaps by engaging another child in a game of rolling. Thus she promotes a cyclical and extremely functional interaction and has the child practice a desired skill, but she has not interrupted the natural flow of his interaction with his environment.

This type of programming is more difficult to monitor. Teachers can keep track of specific targets and numbers of trials which do give information. Data collection and evaluation will not be covered in this paper. However, this approach to programming can provide valid and reliable information which results in ongoing program changes and updates. Whether program activities are structured and presented in training sessions (as in the behavioral example) or are more functional and presented in an ongoing fashion throughout daily activities, it is imperative to document child progress. Data on a child's performance in a program is essential for monitoring individual progress. Individual programs could be regarded as mini-research projects which collectively provide information on communication development.

SUMMARY

One of the main purposes of this chapter has been to provide support to the current language theory that suggests there are basic cognitive prerequisites to language development. This throws new light on both assessment and intervention techniques. It seems we must know how a child is relating to his environment so we can provide the most appropriate experiences for his communication/ language development.

At this time when the area of infant development is the subject of intensive research, communication development is but one area to be considered. The people now working in this area are laying the groundwork for the future methods and procedures in infant assessment and intervention. Given that, it is extremely important that projects share their data in an effort to facilitate this research in all areas of infant development, assessment, and intervention.

APPENDIX 1
GENERAL DESCRIPTION OF PRAGMATIC CATEGORIES

(Supplement to presentation by T. Coggins & R. Carpenter, "A System for Coding Pragmatic Behaviors in Preverbal Children," American Speech and Hearing Association Annual Convention, San Francisco, 1978)

REQUESTING:	Solicitation of a service from a listener. Three types of requests are delineated: *Object* requests are gestures and/or utterances which direct the listener to provide some object for the child; the object is usually out-of-reach because of some physical or spatial barrier. *Action* requests are gestures and/or utterances which direct the listener to act upon some object in order to make the object move. The child's interest appears to be in the action of an object rather than the object *per se*. *Information* requests are gestures and/or utterances which direct the listener to provide information about an object, action or location.
PROTESTING:	Gestures and/or utterances which express disapproval of an adult action or utterance.
COMMENTING:	Direction of the listener's attention to some observable referent. Two types of comments are delineated: *Object* comments are gestures and/or utterances which appear to call the listener's attention to some object identified by the child. *Action* comments are gestures and/or utterances which appear to call the listener's attention to the movement of some object rather than the object *per se*.
GREETING:	Gestures and/or utterances, subsequent to the entrance of a person into a situation, which express recognition.

Applications

TRANSFERRING:	Primarily a gesture, the intent of which is to place an object in another person's possession.
SHOWING OFF:	Gestures and/or utterances that appear to be used to attract attention.
ACKNOWLEDGING:	Gestures and/or utterances which provide notice that the the listener's previous utterances or gestures were received.
ANSWERING:	A gesture and/or utterance from the child in response to a request for information from a listener.

APPENDIX 2
SENSORIMOTOR PERIOD STAGES

Stage 1 (0-1 mo.)	-Infant's interaction with environments is largely reflexive. -Reflexes present at birth undergo change as a function of repeated practice. -Reflexes at birth are the initial components (building blocks) of human cognitive growth.
Stage 2 (1-4 mo.)	-Infant continues to develop the reflexive sensorimotor schemes present at birth. -Gradual integration and coordination of one scheme with another: eye-ear, hand-mouth, hand-eye. -Infant engages in repetition of responses (primary circular reactions) (objects responded to in terms of the opportunity they allow for the practice of sensorimotor schemes).
Stage 3 (4-8 mo.)	-Improved hand-eye coordination. -Circular reactions: repeated attempts to prolong an act that produces an interesting event. -Beginning to investigate objects based on individual object characteristics rather than merely exercising a motor scheme. -Beginning of imitation of visible behaviors that are already a part of infant's motoric and/or vocal repertoire. -Rudimentary object concept (i.e., partial hidings, anticipates position of moving object).

Stage 4 (8-12 mo.)	-Emergence of intentional means-ends behavior (only already familiar schemes are used as a means). -Improvement in imitative behaviors (begins to imitate novel and invisible behaviors). -Object concept: active search for hidden objects (evidence of systematic search errors). -Causality concept: physical/spatial contact seen as prerequisite for causal connection.
Stage 5 (12-18 mo.)	-Often called the last "pure" sensorimotor stage. -Balance shifts from dependence on incorporated motor patterns to emphasis on perceptual evidence. -Infant actively seeks new means through differentiation of old schemes, although problem solving techniques continue to consist mainly of trial and error manipulations. -Object concept: can deal with visible, but not invisible displacements (i.e., unable to represent an unseen, easily inferred, movement of an object once it is hidden under screen).
Stage 6 (18-24 mo.)	-The end of the sensorimotor period is marked by schemes being internalized, as evidenced by: 1. solving problems and inventing new means through mental combinations rather than overt trial and error (internal representation). 2. ability to search successfully for object even when some displacements must be inferred. 3. deferred imitation. -Infant can now differentiate objects from his immediate action on them. -Child interacts with objects on a functional/social basis (rather than objects being used for the sole purpose of exercising sensorimotor schemes).

APPENDIX 3
INDIVIDUAL IMPLEMENTATION PLAN

Student:
Skill Area:
Initiation Date: Ending Date:
Trainer:
Concurrent Communication Program Monitoring Schedule:

Long-term Objective:

Short-term Objective:
Person Responsible:

Objective & Analysis	Training Environment	Strategies & Techniques	Materials & Content	Student Behavior	Criteria for Change	Date Init. End	Trials to Criteria
-State the skill that is to be trained -Break behavior into small steps (include probes)	-Location of training -Type of environment and stimulus arrangement -Group or an individual -Frequency of training -Length of session -Placement	-Type of training strategy -Conditions of training -Number of trials per block per session -Type of measurement -Type of recording -Type of consequences correct/incorrect -Schedule of consequences -Data system	-Type of materials -List specific content	-Specify correct behavior -Specify approximate behavior -Specify incorrect -Specify time allowed for correct response -Specify related behavior	-Specify advance criterion for each step -Specify check criterion for each step -Specify criteria for program completion		-List number of trials to criterion fo each step

Source: Stremel-Campbell, 1977

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SOCIAL DEVELOPMENT AND ASSESSMENT

Phyllis Doyle

Traditionally, research on social behavior has lagged behind the investigation of cognitive behavior (Schaffer, 1974). Attempts to map out the development of social behavior have yielded sequences of behavior filled with large gaps, especially in the age range of birth to two years. Previously, emphasis in developmental research was on the environment's effect in shaping the child. That approach is currently being challenged by many investigators who believe that the individuality of the infant may play an important part in shaping the outcome of his relationship with his caregivers. If this is true, there are many reasons for evaluating the social aspects of the infant's behavior as early as possible.

This chapter describes several methods which are currently being used in clinical and research situations to evaluate the early social behavior of infants. Potential application of these measures to atypical populations and implications for intervention will also be discussed briefly.

A number of studies done in the 1950s and early '60s viewed the infant as a passive recipient of stimulation. Parents were identified as chief influences responsible for molding infants' behavior and, in so being, determine to a large extent their later personality. The major responsibility for socializing the infant was attributed to the mother.

Several attempts were made to correlate parental practices with subsequent child behavior. One of the better known studies in this area was done by Sears, Maccoby and Levin (1957). These investigators identified eight factors which appeared to underlie a wide variety of discrete parental behaviors. Two factors identified by this research were permissiveness-restrictiveness and warmth of mother-child relationship.

Yarrow, Campbell, and Burton (1968) made an attempt to replicate some of the Sears et al. (1957) findings and were largely unsuccessful. They concluded that the role of maternal influence on child behavior needed further study before conclusions could be drawn. Cairns (1972) supports this position by pointing out that summary variables such as maternal warmth and dependency have not provided stable information about antecedent-consequent relationships in parent-child interaction.

Finally, Lamb (1977a) and Bronfenbrenner (1974) both report the presence of second order effects in the child's social interaction. In other words, the presence of another person (parent or stranger) influences the dyadic interaction between child and parent. Lamb (1977b) also points out that the effect on the parent's behavior is equally dramatic, and it is not clear whether the babies simply respond to changes in the parents' behavior or vice versa. These and other studies confirm that a unidirectional approach to the study of infant-caretaker interaction is no longer valid.

In an attempt to understand this complicated interaction, several investigators have focused on the infant's behavior in dyadic interaction in an effort to separate the contributions made by the infant from those of the caregiver. Research findings indicate that at birth or shortly thereafter, infants are cognitively capable of discriminations necessary to engage in social interaction. Even though the specific mechanisms are yet to be described, it is clear that infants contribute to the interaction. For instance, Stern's (1971, 1974) analyses of patterns of dyadic gazing between mother and child are especially important. His findings suggest that infants modulate interaction by averting their gaze when the stimulation provided by the mother is too intense. On the other hand, when adults are unresponsive, infants have been reported to intensify their efforts to elicit attention and reaction before crying or withdrawing from interaction (Carpenter, 1974; Carpenter, Tecce, Stechler, & Friedman, 1970; Tronick, Adamson, Wise, Als, & Brazelton, 1975).

It has also been suggested that infants are able to differentiate social and non-social stimuli (predominantly visual) from two months of age (Carpenter, 1973; Fantz, 1963). More recently, Als, Tronick, Lester, and Brazelton (1977) have observed differential behavior with objects and persons from three weeks of age. The reported findings not only indicate that infants make a substantial contribution and aid in shaping the interaction, but that marked individual differences in infants are apparent at birth. It would follow that each infant has a unique effect on its interactions with caregivers.

Condon and Sander (1974) have argued that a predisposition toward reciprocal social interaction is evident in the activity patterns of newborns. Their research is supported by observations of Brazelton and Robey (1965) that rhythmic approach-withdrawal body movements occur during mother-infant interaction. Thomas, Birch, Chess, Hertzig, and Korn (1963) and Thomas, Chess, and Birch (1968) have studied the individual differences in responsiveness of infants and suggest that the constitutional nature of the child and the modality and means of approach generally preferred by the caretaker have important influences on development.

One of the earliest signs of this individuality can be seen by examining the cry response. Individual differences in the duration of the various sequences of the response and the intervals between them have been found, and it is likely that a mother will respond differently to different babies (Wolff, 1969). For example, brain-damaged infants may show quite irregular crying patterns. Under these circumstances the signaling capacity of the baby may be adversely affected, with considerable implications for the mother's ability to care for the child. The end product we are likely to see is a disturbed mother-child interaction (Schaffer, 1974).

Indeed, the success of the early interaction, which many believe forms the foundation of infant-adult attachment (e.g., Ainsworth & Bell, 1974; Bowlby, 1969), appears to depend largely on the sensitivity of the adult to the infant's signals, as well as the infant's sensitivity to the mother (Ainsworth et al., 1974; Lamb, 1976). Experimental studies indicate that by at least three months of age, infants have developed expectations that adults will behave in a contingent and reciprocal fashion, and that they are distressed when these expectations are violated. Presumably, these expectations about the behavior of adults develop from previous interactional experiences and signal the beginning of the rapid expansion of the infant's capacity for social interaction (Lamb, 1977).

ASSESSING SOCIAL INTERACTION

Brazelton (1973) states that the infant's behavior when combined with maternal expectation can be used to predict the outcome of their early interaction. In order to document the infant's contribution to the interaction, it is necessary to assess differences in neonatal behavior. Brazelton also stresses that neonatal behavioral and psychologic precursors of abnormal development and of individuality in normal development need to be as clearly documented as the neurological precursors. Neurological examinations have not been predictive of tremendous variations in normal or even the milder abnormalities of development. He hopes that documentation of the wide span of behaviors available to neonates may reveal some of the precursors for their later personality development.

The Neonatal Behavioral Assessment Scale (NBAS) (Brazelton, 1973) was developed for this purpose. It is a psychological scale for the newborn infant and, according to the author, allows for the assessment of the infant's capabilities along dimensions relevant to his developing social relationships. It is designed for assessing full-term normal infants and begins with four habituation items which measure rate of decline in responding to repetitious presentations of a light, bell, rattle and pin prick. The rate of shutdown in responding reflects the efficiency of information processing and the organization of protective mechanisms available to the infant. The observation of response decrements is followed by the assessment of neonatal reflexes, motor tone evaluations, observation of response to uncovering, undressing, and responses to aversive stimuli. Initial and predominant states are noted and major state changes are counted. Consistency of newborn test performance across situations has been demonstrated by Sostek (1978).

Several techniques are available for analyzing NBAS performance. One method of interpretation was developed by Als et al. (1977) according to four a priori dimensions: (a) social interactive processes, which include orientations, alertness, consolability, and cuddliness; (b) motoric processes, consisting of reflexes, activity, muscle tone, motor maturity, hand-mouth coordination, and defensive movements; (c) state modulation, consisting of response decrement, state liability, and irritability items; and (d) physiological response to stress, which includes excessive startles, tremors, and skin color changes.

Sostek (1978) assessed full-term, healthy prematures, sick prematures, and infants of diabetic mothers at the time of hospital discharge. She reported that the NBAS scoring dimensions of the high-risk newborns were significantly more worrisome for social interactive and motoric processes.

Systematic studies are currently being carried out to investigate use of the scale as a tool in mother-infant interaction. The experience of professionals has revealed its potential use as an intervention for facilitating parent-infant interaction. Upon viewing administration of the NBAS, parents are usually favorably impressed with their infant's sensitivity and responsiveness. Additionally, they usually enjoy the opportunity to observe the examiner's methods of working around the infant's states of arousal.

An adaptation of the NBAS called the Mother's Assessment of the Behavior of her Infant (MABI) has recently been developed (Field, Dempsey, Hallock, & Shuman, 1978). The MABI emphasizes the interactive rather than the reflex items and utilizes four- rather than nine-point ratings. Mothers of newborns assessed their infants very much as did trained examiners with the exception of one area: mothers tended to score social interactive processes less favorably. The authors suggest this tendency is probably due to the mother's lack of experience in eliciting optional performance on the test item.

The NBAS and MABI can provide guidelines for teaching mothers and fathers about their newborn's state changes, temperament, and individual behavioral patterns. Parents can learn effective and easier ways to interact with and make adjustments to their infants. If a mother perceives her baby as not being cuddly, she may need to know that the infant's cuddliness is uniformly the same with other caregivers (Erickson, 1976; Field et al., 1978).

While the NBAS is useful for assessment in the first few days and actually can be used up to six weeks of age, there has been a gap in assessment for the four- to eight-month period. The Infant Temperament Questionnaire (Carey & McDevitt, 1977) fills this gap. The questionnaire is a multiple-choice version of the Thomas et al. (1968) Temperament Interview used in the New York Longitudinal Study. It includes 70 items with three choices each and requires about 20 minutes to administer and 10 minutes to score. The questions concern sleeping, feeding, soiling and wetting, diapering and dressing, bathing, visits to the doctor, responses to illness, people, reactions to new places and situations and play behaviors. Although the questionnaire was designed for four- to eight-month-olds, adaptations are available for use up to one year of age.

The items can be grouped into nine summary categories: (a) activity level; (b) rhythmicity or regularity; (c) adaptability to change; (d) approach; (e) threshold to stimulation; (f) intensity; (g) mood; (h) distractability from interesting stimuli and crying; and (i) persistence. Each category receives a score corresponding to low, medium, or high. As Carey and McDevitt point out, however, both interview techniques are based on mother's reporting and no concurrent, direct observational studies have been carried out to validate them further.

In addition to the individual dimension scores, the Carey questionnaire can be scored for difficulty or ease of temperament. As in the New York Longitudinal Study (Thomas et al., 1968), a difficult temperament is characterized by irregularity, slow adaptation, initial withdrawal, high intensity, and negative mood.

Field et al. (1978) found that prematures who had had serious respiratory distress were more difficult than normal full-terms at four and eight months. Observational data also indicated differences in mother-infant interaction patterns among these groups at three-and-a-half months of age. Finally, and perhaps most interestingly, four- and eight-month ratings correlated significantly. Such a correlation is evidence of the stability of temperament over short periods of time (Sostek, 1978).

At the same time that stability was reflected, the majority of difficult children shifted toward easier clusters. The implications are that there is justification for cautious optimism in dealing with infants with difficult temperaments. Infant characteristics associated with continued difficulty may suggest to the clinician which individual children are more in need of intervention, or at least re-evaluation at a later date. The difficult infant with either high activity or very negative mood appears more likely to be judged difficult in early childhood than the difficult infant with moderate ratings in both of these categories (Carey & McDevitt, 1978). Carey and McDevitt stress that temperament ratings alone do not constitute evidence of behavioral disorder, but follow-up may be indicated where discordant interaction between parent and child is present or seems likely to occur.

Active, difficult children undoubtedly annoy their teachers more than most, and this may lead to referrals resulting in the diagnosis of hyperactivity. However, there is no evidence from the New York Longitudinal Study or Carey's population that abnormalities or cerebral function are more likely to be found in difficult children.

Clearly, decisions about interventions during the first year of life will differ depending on how adaptively the parents are responding to their infant's temperamental characteristics. Assessment of infant temperament can help parents determine alternatives in handling, caring for and interacting with their infant. It also helps the professional understand what the infant is like and what the parents may be experiencing with the infant's behavior in the home (Erickson, 1976).

If parent-infant interaction has a major influence on infant development, then it is important for parent-infant education and intervention programs to look at those parent behaviors which foster that development. The Parent Behavior Progression (Bromwich, Khoka, Fust, Baxter, & Burge, 1978) is a tool designed to sensitize intervention staff to the feelings, attitudes and behaviors of parents. The information obtained from it can be used to help parents achieve greater enjoyment, satisfaction and competence in their role. It is founded on the principle that when a parent achieves mutually satisfying interaction with her infant and acquires sensitivity and responsiveness to his needs in different areas of development, she creates an environment in which the infant is able to develop to his fullest potential.

The Parent Behavior Progression (PBP) consists of six levels. Each level is made up of a series of statements describing behaviors which reflect attitudes and feelings of parents, as well as patterns of parenting. The author emphasizes that in order to utilize this instrument in an appropriate manner, the information needed has to come from observations and conversations in the context of an ongoing relationship between parent and staff. Suggestions for using the PBP with parents of handicapped infants are given in the instruction manual. It is pointed out that during periods of intense stress it is more productive to focus on behaviors which deal more specifically with things that the parent can do with and for the infant. Intervention which allows the parent to set her own direction and pace in her interactions with her handicapped infant is most likely to lead ultimately to mutually satisfying transactions between parent and child (Bromwich et al., 1978).

Another instrument that can be used to help support and build optimal interactions between the parent and infant is the Home Observation for Measurement of the Environment (HOME) (Caldwell, 1978). It is designed to sample certain aspects of the quantity and quality of social, emotional, and cognitive support available to a young child (birth to six years) within his home. The selection of items was based on: the importance of the opportunity to form a basic attachment to a mother or mother substitute; an emotional climate characterized by mutual pleasure, sensitive need-gratification, and minimization of restriction and punishment; a physical environment that is both stimulating and responsive, offering a variety of modulated sensory experience; freedom to explore and master the environment; a daily schedule that is orderly and predictable; and an opportunity to assimilate and interpret experience within a consistent cultural milieu.

Applications

Caldwell's objective in designing this inventory was to assemble a set of items to assess those qualities of person-person and person-object interaction which collectively comprise the infant's learning environment. The development of this inventory represents a conviction that such a gross structural designation as social class is insensitive to the cumulative transactions that occur daily between the infant and his environment and that an attempt to describe and measure these transactions will not only provide a more accurate description of the learning environment but will also help to pinpoint areas in which intervention is needed.

The inventory is administered by a person who goes into the home at a time when the child is awake and can be observed in his normal routine for that time of day. Items are based both on direct observation of the interaction between caretaker and the child and interview data. In the 1978 version of the HOME, priority was always given to observation whenever an observationally-based item had statistical attributes similar to one derived from the interview.

The HOME can be used as a means of providing feedback to parents about the way they regulate their child's environment. As an infant progresses in his adaptive functioning, there are corresponding needs for the developmental environment to change simultaneously. Parents may need help in creating and sustaining an environment that is most suitable for their child or may need reassurance that the environment they are providing is appropriate to enhance the child's growth and development. Sometimes parents try too hard, expect too much of themselves, and go to extremes in doing the "right thing" for their child. Parents may need support to relax their efforts and to give themselves credit for the appropriate environment they have created and maintained for their child.

These four assessment instruments contribute information about the social world of the infant. Certainly, many questions remain about the reliability and validity of infant assessment. Studies have been or are being conducted to address these questions for the Neonatal Behavioral Assessment Scale (Carey & McDevitt, 1978; Sostek & Anders, 1977; Sostek, 1978) and the Home Observation for Measurement of the Environment (Bradley & Caldwell, 1976; Hollenbeck, 1978).

IMPLICATIONS FOR HANDICAPPED INFANTS

There is reason to believe that the behaviors and interactions measured by these four scales are frequently disturbed in handicapped infants. For example, Fraiberg (1971) found that mothers of blind infants frequently have difficulty in feeling attached to and loving toward their infants because of the lack of eye contact and the lack of development of the social smile. But when these parents were helped to read the other bodily signals of pleasure and displeasure, their reports indicated that they had become more emotionally involved with the infant.

The nature of the child's handicap may also cause the child to be considered temperamentally difficult. Intense reactions to new experiences, abnormal muscle tone, poor bodily rhythm, and other irregular patterns of behavior place an enormous strain on the parent-child relationship and may affect patterns of caregiving.

The child's physical disabilities may restrict the kind of experiences he can manage on his own, and the caregiver's own willingness and ability to provide these experiences may depend upon the quality interactions with the infant. The cognitive and emotional-social domains are linked in important ways. The development of strong attachments seems to require that the child has achieved some ability to discriminate among people and has some notion of object permanence. But these cognitive accomplishments are in turn affected by the richness and variety of the child's experiences. So a child whose experiences are necessarily restricted because of physical limitations may also be delayed in social development.

It would seem that further study is needed to determine the potential applicability of these scales to the handicapped. Meanwhile, findings from the use of these scales and other research will provide us with information about the developmental sequence of social behavior. The teacher of handicapped infants will want to rely on knowledge of developmental sequences when assessing behavior and designing programs for intervention.

Second, the awareness of differences in infants' orientating and signaling behavior and the effects on caregiver-infant interaction as demonstrated by Fraiberg (1971) have important implications for designing intervention programs for handicapped infants and their parents.

Third, knowledge of the child's home environment may contribute to an understanding of his behavior in the preschool classroom. For example, a delay in reaching ability may be more clearly understood if one sees little opportunity in the home environment for the child to develop this skill. Working with parents to insure that the child is receiving the most advantageous stimulation at home is an important function of any early intervention program.

Finally, working with parents in a supportive manner and using knowledge of development sequences, assessment profiles and progress data to reinforce the strong aspects of the parent-infant interaction are crucial functions of early intervention.

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METHODS OF ASSESSING MOTHER-INFANT INTERACTIONS

Craig T. Ramey

Intervention programs aimed at helping the handicapped or at-risk child frequently attempt to modify the behavior of mothers or other caregivers to make their behavior more developmentally appropriate. However, the attempt to evaluate the interactions of mothers and infants as part of the evaluation of early intervention projects is rare. This scarcity is due, in part, to the lack of assessment instruments for parent-infant interactions. Further, it is particularly difficult to construct common mother-infant dyadic assessment devices for children who vary widely in their handicapping or at-risk status. Instruments or techniques that are appropriate for blind infants and their mothers may not be appropriate for deaf infants and their mothers. Given that situation, many projects are forced to construct their own assessment devices to insure that they are appropriate to their specific population. The purpose of this chapter is to summarize general ways in which observational techniques may be used as part of an evaluation strategy for handicapped or at-risk mother-infant dyads.

GENERIC METHODS

The generic ways in which data may be gathered concerning mother-infant social interactions do not differ fundamentally from the methods of studying any other social interactions. These methods are discussed here.

VERBAL STATEMENTS GATHERED FROM INTERVIEWS WITH PARENTS These records may be obtained either about the parent's and child's current functioning or they may be retrospective in nature. They may be obtained either in an unstructured interview situation or in a more structured situation which leads to the completion of some form of rating scale (Schaefer, 1971; Schaffer & Emerson, 1964; Sears, Maccoby, & Levin, 1957).

NATURALISTIC OBSERVATIONS An observer records the ongoing behavior of persons without attempting to alter either the location, form or frequency of occurrence of the behaviors of interest. Naturalistic observations may employ either an obtrusive or unobtrusive observer. Unobtrusive observations are conducted "in the field." One selects a particular set of behaviors and a site where these behaviors are likely to be found naturally and makes observations either with or without predetermined codes. For example, one might observe and record behaviors emitted by parents and their children in parks, on playgrounds, in supermarkets or in any other location in which parents and children are likely to be found. Ideally, the persons being observed would be unaware of the observer's presence or that observations were being made (Anderson, 1972; Jones & Leach, 1972; Rheingold & Keene, 1965). Naturalistic observations are also conducted when there is no possibility the observer can be an unobtrusive presence. Many observations of parent-child interaction occur in the home (Ainsworth & Bell, 1969; Clarke-Stewart, 1973; Tulkin & Kagan, 1972). It is quite likely that the presence of an observer will affect parental behavior particularly if the parent is aware of the behaviors under observation. The extent of such influence and the differential impact it may have on groups of parents is a relatively unexplored, though important, issue.

STANDARDIZED OBSERVATIONS These are used when no constraints are placed upon the behaviors which may be emitted and no particular behaviors are requested. The physical context in which the behaviors are to be observed is typically held constant by observing the subjects in a common setting such as a laboratory room. This procedure may also be thought of as a controlled naturalistic observation (Bee, Van Egeren, Streissguth, Nyman, & Leckie, 1969; Lewis & Goldberg, 1969; Ramey & Mills, 1975).

CONSTRAINED OBSERVATIONS These are frequently selected when the investigator is limiting his attention to a few prespecified behaviors in which he has a particular theoretical interest. For example, one might be interested in the effectiveness of a mother's teaching style when she has been asked to teach her child a particular task. By selecting the task, the related behaviors to be coded and the location in which the observations are to be made, one has manipulated possibly significant factors which influence the form of the parent-infant interaction. By so doing one has constrained the situation so that he is most likely to observe those behaviors in which he is most interested (Ainsworth & Bell, 1969; Bee et al., 1969; Stern, 1974).

Each of these four general approaches has advantages and disadvantages associated with it. Verbal statements and naturalistic observations are both excellent means of gathering data which can be used to generate hypotheses. These methods are most profitably used when a new line of inquiry is being developed. Verbal statements, gathered in an interview context, are less time-consuming and expensive to obtain than naturalistic observations. But they are also potentially more subject to intentional or unintentional bias due to such factors as selective memory for past events and/or the tendency to answer questions in a socially desirable manner.

Standardized observations have, by definition, the advantage of creating the context in which the behaviors are to be observed. Thus, typically one would use this approach to examine individual differences within some set of dimensions which had been identified in less structured situations. The main disadvantage of standardized observation lies in the construction of the situation itself. The principal danger is that one will construct an atypical context for the observation of the dyad and, hence, generate data with limited generality to other, and perhaps more appropriate, real-life settings. Finally, the use of constrained situations in which some aspect of the context is manipulated or systematically altered tends to allow explicit hypotheses to be brought under experimental test. As with standardized observations, one must constantly be concerned about the issues of external validity and generality of findings. However, with this technique one is able to move beyond correlational statements about the relationships among variables and begin to formulate causal inferences.

Standardized and constrained observations are often used for the purpose of determining individual differences. When the situation is held constant with behaviors or contextual variables manipulated, individual children's response characteristics may be correlated with other independent variables (e.g., sex, age, social class, mother-infant interactions at home). But comparing individual differences in a constant situation does not remove the possibility that individual dyads are affected by factors unmeasured by the investigator: for example, in a study by Randall (1975) working class mothers' language was more affected by an observer's presence than middle class mothers'. Although standardized situations allow the possibility of causal inference, they alone cannot explain mother-infant interaction. Observations taken in a variety of situations and utilizing several of the four approaches outlined here will provide a more comprehensive, and perhaps accurate, picture of the mother-child relationship.

OBSERVATIONAL TECHNIQUES

Although the major modes for gathering observational data are well known, the advantages and limitations of each mode warrant comment.

LIVE OBSERVATIONS In this situation the observer records behavior as it is occurring *in situ*. Because there is no possibility of viewing the same sequence of behaviors again after they have occurred, it is necessary to have a well-developed coding scheme before formal observations are begun. Further, because the number of different categories used generally varies inversely with estimates of inter-observer reliability, one frequently is well advised to limit observations to a relatively small number of behaviors. However, these limitations are offset in part by the observer's ability to alter physical perspective quickly to maintain the optimal vantage point for ongoing interactions (Brown, Bakeman, Snyder, Frederickson, Morgan, & Helper, 1975; Rheingold, 1969).

FILM Film is an excellent medium in which to preserve complex interactions. It is very resistant to deterioration over time, thus allowing multiple viewings of particular interchanges. There are, however, several major limitations to the use of the film. First, the view through a camera is almost always more restricted than the naked eye. Second, one must wait for the film to be developed before coding can begin. Third, it is a relatively expensive process. However, individual frames of film make excellent units of analysis, whether one examines every frame or samples from them (Carr, Dabbs & Carr, 1975; Condon & Sander, 1974). This capability is particularly advantageous when one is interested in the durations and sequences of behavior which are very brief--say, less than one second in duration.

VIDEOTAPE Videotape shares many of the advantages and disadvantages of film. For instance, one is limited by the field of the camera. However, videotape is comparatively inexpensive and available for instantaneous coding. In fact, one can code "live" from a monitor while the behavior is ongoing and erase the tape if the coding has proceeded satisfactorily, something which obviously cannot be done with film at this time. Good videotape recorders are now equipped with slow-motion and stop-action features. These features in combination with digital clocks which can be used to superimpose times in almost any units onto the film allow careful scrutiny of even the most rapidly occurring behaviors (Kaye, 1975; Ramey & Mills, 1975).

CATEGORIZATION OF BEHAVIOR

No matter how thoroughly one attempts to describe behavior in any given setting, the resulting description is an abstraction and summarization of selected aspects of that situation. Thus the coding system that one constructs or chooses is a matter of critical importance. It is obvious but worth restating that there is no single system which is universally best. A coding system must be chosen to fit the particular interests of a given line of inquiry. Observations of a general nature such as "mother-infant interaction patterns" require the development of a broad coding scheme which will capture all of the interactive behaviors observed. When the questions raised about dyadic interaction are more specific (i.e., sharing behaviors, maternal teaching style, maternal-infant feeding behavior), the categories become more detailed but are restricted to that subset of behavior in question. The following are some of the more important features to consider in adopting a coding system.

MOLAR VERSUS MOLECULAR CODES The terms molar and molecular in this context refer to the level of abstraction or the breadth of a particular category. An example from a child's behavior may serve to illustrate this continuum. A child may be in a room engaged in mouthing, touching, looking at, and manipulating with his hands a small object, say a block. To code each of these discrete behavioral acts would be to record behavior at a relatively molecular level as compared with coding that he was "playing with a toy." Although there is no inherent value in either coding approach, it is generally useful to code at the smallest behavioral unit which one might wish to select for analysis. One can usually collapse back to larger units if that has been planned into the coding scheme whereas a more global category cannot at a later date be subdivided.

In code construction, it is helpful to be aware of the level of behavioral analysis one needs to answer the questions of the study. Molecular codes are most useful in pursuing specific questions dealing with a subset of behaviors. (See Jones & Leach, 1972, for an example of molecular coding of greeting and separation behaviors between mothers and children.) When one's questions are broad, molecular codes may be less appropriate for several reasons: (1) particular, discrete behaviors may be identical for different molar behaviors, and (2) the number of behaviors to be coded will quickly reach an unrealistic level for high inter-observer reliability to be maintained. Both problems may be resolved to some extent by logical combinations of molar and molecular units. In what is termed a hierarchical code arrangement, molar categories are selected which are then apportioned into finer molecular units. (These "splits" of categories may take place several times until one has developed a hierarchical "tree" with many succeeding levels of detail; see Brown et al., 1975, for an excellent example of a hierarchical code.)

MUTUALLY EXCLUSIVE CATEGORIES VERSUS OVERLAPPING CATEGORIES Although this issue is more of a technical one than a major conceptual issue, it nevertheless merits comment. Essentially, the major question is whether the coding scheme should be elaborated to the level in which each behavior or behavioral complex would have its uniquely valid code or whether one should record behaviors separately while noting their concurrence in time. An example will be used at this point to note some advantages and disadvantages of each approach. Suppose for the moment that one is interested in an infant's looking and vocal behavior in the presence of his mother. One could code these two events separately in which case they would sometimes be occurring independently and at other times they would be occurring at the same instant (i.e., overlapping in time); alternatively one could construct a mutually exclusive coding scheme as follows:

Looking = L
Vocalizing = V
Looking & Vocalizing = LV

In this scheme it would be assumed that if only an "L" were recorded, a "V" was not also occurring--otherwise a separate and discrete code "LV" would have been assigned. Such a mutually exlusive system has several advantages. First, it is possible to ascertain relative proportions of occurrence of behavioral episodes very easily. The major disadvantage of mutually exclusive codes lies in the added memory load required of the observer when large numbers of behaviors are to be coded at the same time. When large numbers of behaviors are to be coded, one typically suffers a disproportionate cost in reliability if mutually exclusive codes are used. More will be said about reliability in a later section of this chapter.

CRITERIA FOR SELECTING BEHAVIORS TO BE OBSERVED

Once an investigator has chosen a particular domain of parent-infant interaction for analysis, several considerations may be of help in selecting particular behaviors to be coded. Chief among these considerations, as Weick (1968) points out, is that any category of behavior be explicit. That is, precise definitions should exist for each behavior. Precise definitions of observable behaviors will greatly aid the achievement of acceptable inter-observer reliability. Explicitness includes consideration of the extent to which human observers must interpret the behaviors which occur to assign them to a particular coding category. In general, the less interpretation required, the faster and more reliably human observers can code what is occurring. For example, it is easier to code an infant's "touching" or "manipulating" an object than it is to code "play" which requires more interpretation as to exactly when it begins.

A second consideration is the extent to which naive observers can master the coding scheme from a set of definitions independent of prolonged formal training in the use of the coding system. Although this consideration is mainly of practical value in that it reduces the amount of time necessary to train observers, it also possesses the additional scientific benefit of allowing immediate determination of the utility of the system by other members of the scientific community.

METHODS FOR RECORDING OBSERVATIONAL DATA

In general, there are four major methods for the collection of observational data on parent-infant interactions. The methods are as follows:

NARRATIVE RECORDS These records may be obtained either by writing a description of ongoing behavior or by dictating a description for later transcription. Although the observer may be interested in particular behaviors, typically these observations are taken without predetermined codes. These records may be either of an event-sequence nature in which the order of the events is preserved but not the times at which they occurred or by a time-sequence method in which time of occurrence is incorporated into the record. For the written record, one typically puts time-lines on a sheet of paper (for example, each line representing a 30-second unit) and moves from line to line at the appropriate interval. For dictated records, the process is basically the same but it is helpful to have signals representing time-intervals dubbed onto the tape prior to the beginning of dictation. The person doing the transcribing then has a "real-time" cue for blocking the transcriptions into uniform intervals.

CODED RECORDS (NON-MECHANICAL) These records, commonly termed a "paper and pencil" technique, involve the use of a predetermined set of categories which the observer either tallies on a code sheet or notes by various symbols. Once again, these codes may either be event-sequenced, in which case the observer scores the behavior without reference to time of occurrence, or time-sequenced with chronological order and often duration of behavior preserved. In time-sequenced observations, one may either make a continuous record, appropriate when the number of behavioral categories is small or, in utilizing a larger number of codes, employ a time-on, time-off method where the observer watches the interaction for a specified number of seconds and then records the codes in the following time-interval. Ordinarily, for purposes of analysis, the latter method assumes that behavior is continuous during the times the observer was recording but not looking. Obviously, the choice of a continuous observe-record method is determined by the level of question being researched. One cannot investigate contingent relationships between discrete behaviors with a time-off procedure.

POLYGRAPHIC RECORDS This technique requires prespecified behavioral categories and, usually, a multi-channel event recorder which can be used to note the beginning and completion of each behavior. From this record, frequencies and durations of behaviors may be obtained and these pieces of information can be subjected either to an event-sequence analysis or to a time-sequence analysis. The major disadvantage of this approach is the large amount of time required to transpose the polygraphic records into digital form for computer analysis.

COMPUTER-BASED ACQUISITION DEVICES This approach also requires a prespecified set of behavioral codes. With this approach, one generally constructs an interface to a computer which can transform numeric or on-off signals into a computer-readable format. One can either be linked to an on-line computer system or to a device which will store information about the events for later computer processing. One such system currently receiving a great deal of attention is the portable Datamyte system manufactured by the Electrogeneral Corporation. The major advantage of such a system is that large amounts of data can be processed quickly and with a minimum of a research assistant's time. However, computer programming skills are necessary to make such a system work efficiently because the essential "software" is not generally available.

RELIABILITY

The issue of reliability in observational data is one that is particularly important and which has received considerable attention (Campbell, 1961; Gellert, 1955; Kaplan, 1964; Medley & Mitzel, 1963). Gellert (1955) suggested a general rule about reliability estimates which is still valid: "The fewer the categories, the more precise their definition, and the less inference required in making classifications, the greater will be the reliability of the data" (p. 194).

RELIABILITY ESTIMATES Although it is not the intent of this chapter to discuss technical issues in detail, a comment about obtaining reliability estimates for mother-child interactions is warranted. Basically, there are two general methods by which estimates of inter-observer reliability may be obtained. These are correlational and percent agreement between observers. The question of which is the more useful and/or appropriate measure is not trivial. When using correlational methods, one typically correlates total scores obtained by two independent observers across a number of observational sessions. Thus, for example, if one were interested in the amount of nonverbal vocalizations emitted by an infant when his mother was present or absent, one might have two observers coding the frequency of vocalization for a number of infants under both of these conditions. The resulting total vocalization frequencies per observation period would then be correlated for the two observers. An alternative to the correlational approach is to calculate the percentage of agreement between the two observers for each incidence of a behavior's occurrence. In general, this is a more rigorous method of estimation. The most rigorous method is to compute the number of agreements over the number of agreements plus disagreements; agreements should be assessed for each behavior as it occurred in time rather than a check of totals per minute or some other summary procedure. (Summary procedures utilizing percent agreement can be as questionable as a correlational method.) In choosing a correlational or a percent agreement method for reliability estimates, the decision should be governed by the level of analysis that is to be performed.

For example, if one chooses to remain at the level of total frequencies or total durations of behaviors, then correlational analyses may be sufficient. However, if one wants to examine the conditional probabilities between several behaviors, then percentage agreement may be mandatory. For example, if one wants to know the probability of a mother touching her infant following an infant's vocalization, then each vocalization and each touch should be examined in determining reliability estimates.

RELIABILITY CHECKS A separate issue from *how* to make reliability estimates is how often and how obtrusively they should be made. The seriousness of this issue for observational studies has recently been emphasized by two studies which determined the unreliability of observational data when the observers did not know they were being checked (Reid, 1970; Taplin & Reid, 1973). A phenomenon which one could term "idiosyncrasy of observations" appeared to occur. In the session immediately following the one in which observers knew their reliability was being checked, regardless of the manner or extent of previous training, observers reverted to a level of agreement at least 20 percent lower than when they were being checked. Despite training to an 80 percent or greater agreement level, the only group to maintain percent agreement at even 70 percent was one believing their reliability was being randomly checked (Taplin & Reid, 1973). The implications of these findings are particularly great for live observations. Observations coded from videotapes can incorporate these results to some extent; videotapes can be randomly assigned to two or more observers with some tapes secretly assigned to both. In this fashion, one creates the illusion of continuous, random check of observer agreement. If Taplin and Reid are correct, however, such a procedure merely assures *less loss* than is obtained with other methods. No similar methods exist for unobtrusive reliability checks on live observations. One must be extremely cautious, therefore, about the reliability of observations taken live. Observational studies often begin with a period of training for observers continued until some predetermined acceptable level of reliability is achieved. The observers are then essentially on their own for the period when observations are taken; it is assumed they will remain at the level of reliability obtained initially. That assumption may be unwarranted.

ANALYSIS STRATEGIES FOR OBSERVATIONAL DATA

Several recent and excellent summaries of data analysis strategies for dyadic interactions have been published (Lewis & Lee-Painter, 1974). Although it is a truism that each study of parent-infant interaction has some unique analysis aspects, there are several major strategies which are in general use and warrant comment.

CORRELATIONAL APPROACHES

Correlations are frequently used to examine individual differences within groups sharing some common characteristic, such as age, social class, or sex of infant. Generally speaking, these correlations are of two types: (1) contemporaneous correlations or (2) time-lagged correlations. Contemporaneous correlations provide a description of the associative strength of various parent and child behaviors when each is measured at approximately the same point in time. Time-lagged correlations (in which the behaviors of one member of a dyad are used to predict the behaviors of the other member at a later point in time) are frequently used to examine the long-term impact of some existing, and presumably, predisposing demand characteristics of one member of the dyad on the other member. For example, Bell and Ainsworth (1972) found that maternal responsiveness to infant crying in the first year of life was related to infant crying in the fourth quarter. Infant crying in the first quarter on the other hand was not related to maternal responsiveness in the fourth. This finding allowed Bell and Ainsworth to conclude that of the two predisposing factors, infant crying and maternal behavior, maternal behavior was the more potent variable associated with later crying behavior. This research is in contrast to previous time-lagged correlational research.

Many studies demonstrate that the behavior of one member of the dyad is related to the behavior of the other at a later point in time (Clarke-Stewart, 1973; Moss, Robson & Pedersen, 1969). However, only by including the behaviors of both members of the dyad at each point in time can one begin to address the question of "direction of effects" in social interaction. More will be said about the direction of effects issue later in this chapter.

SIMPLE AND CONDITIONAL PROBABILITIES

Within the past few years, simple and conditional probabilities have gained in popularity as styles of analysis. To derive simple probability of occurrence estimates, one simply divides an observation session into equal intervals (e.g., ten-second intervals) and notes whether a given behavior occurred within each interval. From this procedure one can derive the likelihood of a behavior occurring which can be expressed as a percentage of total observational intervals.

Applications

More recently, many investigators have attempted to examine the influence of one behavior upon other behaviors by computing conditional probability estimates. For example, Lewis and Wilson (1972) examined the differences in maternal responses to infant vocalizations as a function of the social class of the mother. For their analyses they computed the probability of various maternal behaviors (e.g., touching and talking to the infant) given that the infant had vocalized. Such analyses typically take the form of the following equation:

$$p\ B_x/B_y$$

which is read as the probability (p) of behavior x (B_x) given the occurrence of behavior y (B_y). Although such analyses can be very informative, particularly with respect to typological differences in dyadic behaviors as a function of some predisposing characteristic such as context or social class, there is currently much debate about the most appropriate statistical tests to be applied to determine significance of differences.

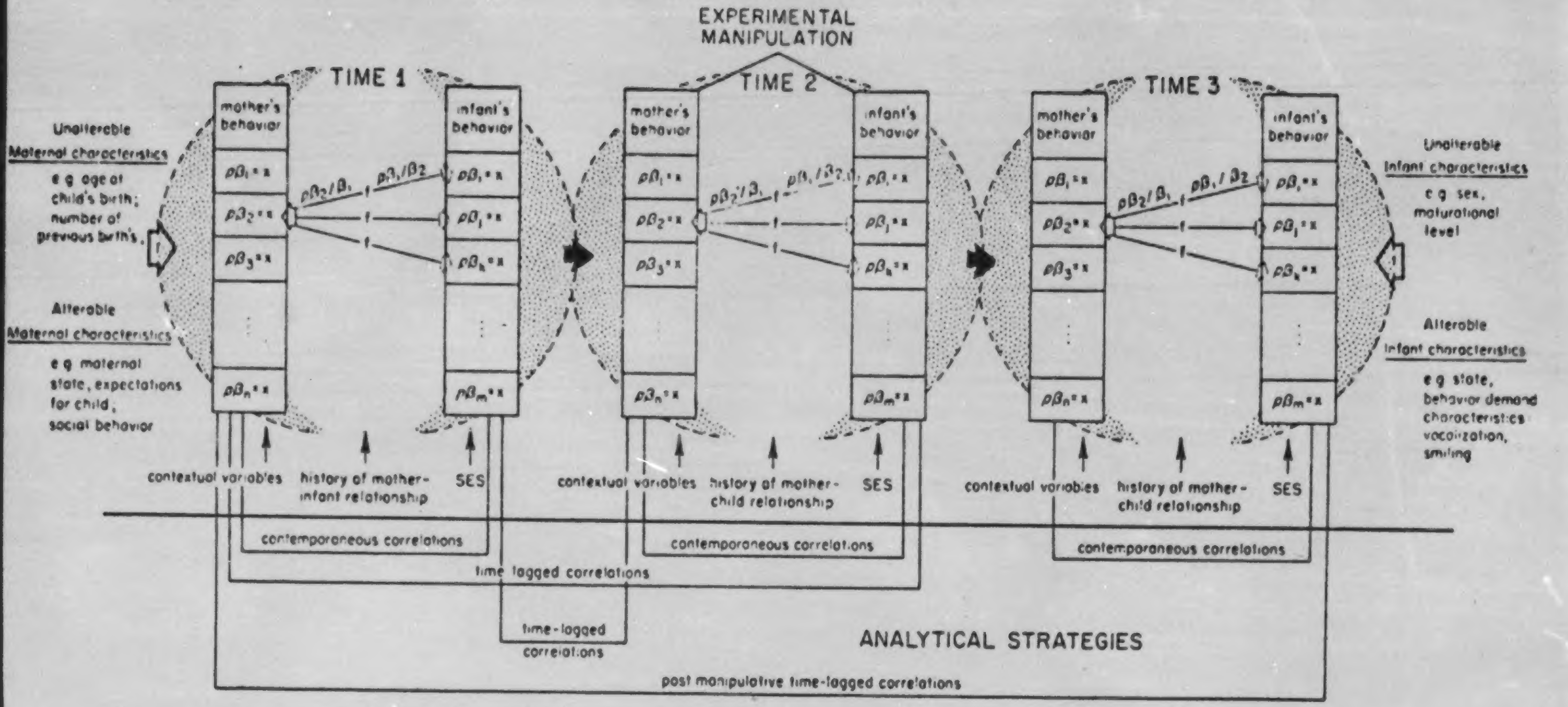
OTHER ANALYSIS STRATEGIES

The most widely used group analysis techniques are parametric and nonparametric approaches such as analysis of variance and Chi Square. These techniques are used to assess differences in performance between groups that vary on some dimension such as socioeconomic status or age. They are excellent and powerful techniques for these purposes, but they usually use summative scores from a session or number of subjects possessing some attribute as the unit of analysis. Therefore, these between-group statistics are of limited use when one wants either to perform fine-grained sequential analyses of the performance of dyads within a particular session or to analyze data obtained from a relatively homogeneous group. These two limitations explain, in part, the increasing use of such analyses as simple and conditional probabilities.

A GENERAL MODEL FOR PARENT-INFANT INTERACTION ANALYSES

Figure 1 is an attempt to summarize in schematic or model form a general approach to the analysis of mother-infant dyadic interactions. No claim for originality is made for the thoughts which this

FIGURE 1
ANALYSIS OF DYADIC INTERACTIONS


EXPERIMENTAL MANIPULATION
TIME 1
TIME 2
TIME 3
Unalterable Maternal characteristics
e.g. age at child's birth; number of previous birth's
Alterable Maternal characteristics
e.g. maternal state, expectations for child, social behavior
mother's behavior
$\rho\beta_1 = x$
$\rho\beta_2 = x$
$\rho\beta_3 = x$
$\rho\beta_n = x$
infant's behavior
$\rho\beta_1 = x$
$\rho\beta_1 = x$
$\rho\beta_k = x$
$\rho\beta_m = x$
$\rho\beta_2/\beta_1$
$\rho\beta_1/\beta_2$
r
Unalterable Infant characteristics
e.g. sex, maturational level
Alterable Infant characteristics
e.g. state, behavior demand characteristics vocalization, smiling
contextual variables
history of mother-infant relationship
history of mother-child relationship
SES
contemporaneous correlations
time lagged correlations
time-lagged correlations
post manipulative time-lagged correlations
ANALYTICAL STRATEGIES

model represents; rather, it is to be viewed simply as an attempt to summarize concisely the major styles of observational inquiry concerning parent-infant interactions to date.

Figure 1 contains a schematic diagram of a set of dyadic interactions distributed over time. Several major features of this model warrant elaboration. The three large circles in the diagram represent points in time which are not necessarily contiguous. Within each time circle there are two rectangles. These rectangles represent the behavioral hierarchies of each member of the dyad (i.e., the probability of occurrence of specific behaviors). It will be noted that within each rectangle (vector) there are a variety of behaviors (B) which have some probability of occurring within that time frame (e.g., pB = X) for each individual. Impinging upon the hierarchies of behaviors at any one time are several variables symbolized by the heavy arrows on the perimeters of the time circles. The variables are: (1) contextual variables such as physical setting, (2) the history of the dyadic relationship, and (3) molar sociocultural influences such as socioeconomic status. Influencing the particular behavioral hierarchies at any one time are a set of predisposing characteristics which can be divided into two classes, alterable and unalterable. For a specific mother, alterable characteristics might include her state, her expectations for her child, or particular social behaviors toward the child; whereas unalterable characteristics might include her age at the child's birth or the number of previous births. For the child in the dyad a similar dichotomy of alterable and unalterable characteristics exists. Unalterable characteristics include such factors as the child's sex and maturational level. Alterable child characteristics include such behaviors as likelihood of smiling or vocalizing.

Although this model is, strictly speaking, a descriptive or summative model (i.e., it provides a framework within which to characterize the current situation), it is hoped that the model will allow the reader to characterize quickly the nature of the studies and experiments which might be developed as a means of assessing or evaluating the impact of early intervention.

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ASSESSMENT OF VISUALLY IMPAIRED INFANTS

Rebecca F. DuBose

As in many fields of study, we find considerable differences among scholars regarding the reasons why handicapped persons as a group function differently. In vision research, the position that it is the physical handicap itself that serves as the source for aberrant development can best be illustrated by Cutsforth's (1951) statement, "No single mental activity of the congenitally blind child is not distorted by the absence of sight" (p. 3). Cutsforth's position clearly illustrates the generalized effects a sensory impairment has on all developmental areas. Perhaps the key to Cutsforth's remark is the word "distorted." Distortion can simply mean that the learning of mental tasks has to proceed in different ways because the visual channel is not useful.

An environmentalist point of view can best be illustrated by Scott's (1963) declaration, "Blind are made, not born." Scott's position attests to the critical effects parents and other caregivers have on shaping the blind child. Likewise, it portrays the malleability of the human being. One need only read Sullivan's very moving autobiography, If You Could See What I Hear (Sullivan & Gill, 1975), to realize that both Cutsforth and Scott are correct: blindness does require that learning be acquired differently, and what the learning is and how it is acquired are greatly dependent on the persons and situations the blind child encounters.

EXAMINER CHARACTERISTICS

The task of assessing the behavioral repertoires of blind children, many of whom have additional impairments, requires far more skill than one commonly acquires in traditional training programs. DuBose (1978) noted the following characteristics observed in examiners who have been successful with this population:

1. Knowledge of the precise sequences by which children acquire skills.
2. Knowledge of the impact certain impairments have on the development of skills.

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3. Ability to determine the most appropriate procedure for presenting the tasks to the particular child.
4. Ability to establish a satisfactory communication system with the child.
5. Ability to select the most appropriate tests/tasks, administer them, or adapt them as needed.
6. Ability to select the most appropriate environments for testing.
7. Ability to time testing periods so as to evoke maximum responses.
8. Ability to manipulate testing conditions to enhance correct responses.
9. Ability to translate findings into functional program plans.
10. Ability to present data in a positive manner. (pp. 3-4)

TEST CHARACTERISTICS

Instrumentation has been a source of other problems, since no mental measures have been standardized on young blind children. Therefore it is necessary to adapt each scale so that items can be used to assess the child's abilities. This presents multiple problems and greatly reduces the validity of the instrument.

In selecting tests or subtests to administer to young visually impaired infants, the following task characteristics are desirable:

1. Select items that require manipulation after the child has had an opportunity to tactually explore the object.
2. Use items that are very clear and have high contrast if the child's vision is to be used.
3. Omit timed items if possible.
4. If the child has language skills, use this as an expressive testing channel.
5. Position the child for testing so that light falls on the task and not on the child's face.
6. Position tasks in the child's optimal visual field.
7. Select tasks that use materials that are timely, as visually impaired children may not have had exposure to as many things as other children.

8. Select tasks that can be easily adapted to provide tactile or auditory input when vision is not a viable input channel.

VISUAL CHARACTERISTICS

Although it is not the role of the diagnostic examiner to test an infant's vision, it is important that the examiner understand what and how well the child sees. While opthalmological reports may be helpful in describing certain physical attributes of the child's vision, these reports seldom provide the functional information examiners need to make decisions about testing. If some visual assessment by the examiner appears necessary, the following screening tests can be used, depending on the child's developmental level.

1. The Snellen Symbol Chart. The Snellen Chart is a chart of symbols that are read at a distance of 20 feet. The basic unit of measurement is a visual angle of one minute of arc, a visual distance clearly distinguished by the normal eye at 200 feet.

2. The Home Eye Test (Boyce, 1973). This test has been successfully used with children as young as age three. It is easy to administer, reliable, and inexpensive. The kit consists of an "E" chart with instructions for training and administration. It is given at a distance of 10 feet.

3. Visual Behavior in Infancy (Appleton, Clifton, & Goldberg, 1975). This chart presents visual expectations of very young infants in the areas of focus and convergence, fixation and tracking, light and color, discrimination, acuity, and maturation.

4. The Stycar Vision Tests (Sheridan, 1973). A distant screening chart of block letters, a Miniature Toys Test, and a Rolling Balls Test are included in the Stycar Test. The various tests are useful with children with different handicaps and functioning levels.

5. A Flash-Card Vision Test for Children (1966). This test was designed for preschool children and has proven successful with children 27 months of age. Three symbols (apple, house, umbrella) are presented in Snellen notation. The children can verbally or manually label or match symbols at 10 feet or less to determine visual acuity.

6. Visual Screening Inventory (Langley, 1979). Adapted from an earlier functional vision screening instrument (Langley & DuBose, 1976), the Visual Screening Inventory was developed specifically for use with severely handicapped children by persons with some knowledge of vision and educational strategies for severely handicapped children.

DEVELOPMENTAL CHARACTERISTICS

A loss of vision impairs a child's development in many ways. In assessing the child, it is important that the examiner be aware of how the impairment affects the acquisition of developmental milestones so that the information gathered on a child can be put into the context of behavior expected when severe visual losses are present.

GROSS MOTOR DEVELOPMENT

Children whose vision is severely limited do not experience space or spatial relationships as do other children. Without perception of what is in space, they are not drawn to objects and people to explore their properties. These factors have affected the blind child's acquisition of motor skills. Additionally, once skills are acquired, they are executed less efficiently than in children who can see how other people perform the same tasks. Table 1 presents developmental milestones comparing sighted and blind infants on tasks of the motor scale of the Bayley Infant Scales. Motor skills that required low and stable centers of gravity such as rolling, sitting, standing alone, and stepping movements with hands held were achieved in blind children around the same age as sighted peers. Skills that required the youngster to project his body into space such as elevating upper torso by the arms, raising to sitting, pulling to stand, crawling, and walking were delayed. Investigating the motor skills of older blind children, Folio (1974) found the more advanced projectile skills of running, hopping, jumping, and skipping to be also delayed.

FINE MOTOR SKILLS

Without visual input the eye-hand synchrony, so critical to the acquisition of sensorimotor schemata, fails to provide support for the development of manual manipulations. The effects of loss of sight have been described by Fraiberg (1977):

> In the biological program it is "intended" that vision and prehension evolve in synchrony. The story of prehension is not the story of the maturational and adaptive functions of the hand alone, but the story of hand and eye, eye and hand. . . . The hand unites the infant with a world "out there," in which the purposeful reach gives intentionality to action and a sense of voluntariness in the formative period of the ego. . . . In cruelest irony, these hands, derailed in their progress by a deficit in the biological plan, must come to serve the blind child as primary perceptual organs--something not "intended," either, in human biology. (pp. 147-148)

TABLE 1
GROSS MOTOR ITEMS AND AGE ACHIEVED BY BLIND (CHILD DEVELOPMENT PROJECT) AND SIGHTED (BAYLEY)

Source: Fraiberg, 1977, p. 204

	Age Range		Median Age		Difference in Median Ages
ITEM	Sighted	Blind	Sighted	Blind	
Elevates self by arms, prone	.07-5.0	4.5- 9.5	2.1	8.75	6.65
Sits alone momentarily	4.0- 8.0	5.0- 8.5	5.3	6.75	1.45
Rolls from back to stomach	4.0-10.0	4.5- 9.5	6.4	7.25	.85
Sits alone steadily	5.0- 9.0	6.5- 9.5	6.6	8.00	1.40
Raises self to sitting pos.	6.0-11.0	9.5-15.5	8.3	11.00	2.70
Stands up by furniture (pulls up to stand)	6.0-12.0	9.5-15.0	8.6	13.00	4.40
Stepping movements (walks hands held)	6.0-12.0	8.0-11.5	8.8	10.75	1.95
Stands alone	9.0-16.0	9.0-15.5	11.0	13.00	2.00
Walks alone, 3 steps	9.0-17.0	11.5-19.0	11.7	15.25	3.55
Walks alone, across room	11.3-14.3	12.0-20.5	12.1	19.25	7.15

Applications

Blind infants maintain their hands at shoulder height in a neonatal posture, interacting only with what is within their immediate grasp. The grasp is clumsy and inefficient due to far less practice than grasps of their sighted peers. The hands act on objects independently with less mutual interplay of digits or on objects. Sighted infants reach out to grasp, and manually explore the things they see. Practice leads to more efficient manipulations and advances in skill attainment.

The importance of the hands of blind children cannot be overestimated. In a recent study comparing reading skills of visually impaired children with those of sighted children, Mommers (1976) reported the way a child moved his or her hand during reading bore a strong relationship to reading ability.

LANGUAGE DEVELOPMENT

Piaget views language as a by-product of logic. Logic emerges from the general coordination of actions during the sensorimotor period. Blind children, lacking in the abundance of experiences necessary for the development of operational structures, appear deficient in logical operations (Swallow, 1976). Friedman and Pasnak (1973) found blind children to be impaired on verbal and manipulative tasks when the tasks involve conceptual abilities. Warren (1977) reviewed the few studies specifically related to the development of language in children and concluded that blind children develop the expected language, although some differences are noted before four and five years of age.

Sighted babies say two words by an average of 14 months of age, while blind babies did not achieve this milestone until 18.5 months (Fraiberg, 1977). Early words are related to direct experience with objects, events, or things present in their environment. The blind child's limited experiences and mobility may be the reason for this delay. Similar reasoning explains the six-month lag noted in the Bayley test item "sentences of two words."

Particular words or concepts are understandably delayed. Attributes and qualities which are not readily experienced thus are slower in appearing in the vocabulary of blind children. Sighted children represent themselves in play through the use of "me" and "I" when they are around 2½ years of age. Blind children do not use these references until they are 3 to 4½ years. Although specific words enter the vocabularies at different times, the basic structures of language in blind and sighted children are apparently very similar by the time the children are five years of age.

COGNITIVE DEVELOPMENT

Piagetian research indicates that blind children are slower in movement through different stages of development. The effects of blindness on sensorimotor development can be seen in Table 2. The most obvious delay experienced by blind infants is in object concept. This delay adversely impacts upon the acquisition of spatial concepts and causality.

Stephens and Simpkins (1974) investigated reasoning, moral judgment, and moral conduct in congenitally blind children and found significant deficiencies in the blind children's logical reasoning. Logical reasoning, they concluded, was related to classification skills which involved spatial orientation and mental imagery.

The blind child's world supplies him with less information than can be readily processed into knowledge. The need to provide the developing blind child with concrete objects and appropriate verbal interaction as to associations, generalizations, and classifications is essential.

SOCIAL AND EMOTIONAL DEVELOPMENT

The success with which a blind child acquires the skills that enable him to live in harmony with those around him and to care for his own physical, mental, and emotional needs is the critical factor that will determine his adjustment to life. The key to the development of appropriate social and emotional responses in the blind child is the relationship between the blind child and his parents. DuBose (1976) compared the role that parents must play in the blind child's life to birth--a letting-go process that must occur if the child is to be a self-sufficient member of society.

The social attachment of the child to his primary caregiver, usually the mother, has been thoroughly investigated in literature on infancy (see Stone, Smith, & Murphy, 1973). Social attachment and interaction between the blind child and his mother develops differently when the child is blind. Freedman (1964) observed

TABLE 2
EFFECTS OF BLINDNESS ON SENSORIMOTOR DEVELOPMENT

Period	Expectations	Blindness
I. Reflexes (0-1 month)	The infant's behavior is characterized primarily by reflexive responses to his own body and to some aspects of the external world. Some refinement of reflexive behavior occurs as the infant discovers, for example, that some objects are "suckable" and some are not.	-No pupillary restrictions to light in some cases.
II. Primary Circular Reactions (1-4 months)	The infant begins to repeat selectively those actions that produce effects that are interesting or satisfying to him. These actions are primarily directed to his own body rather than to external objects.	-No visual tracking. -No examination of feet and hands. -No intentional grasping of objects.
III. Secondary Circular Reactions (4-9 months)	The infant reproduces behaviors that produce effects in the external world that are satisfying or interesting to him. This stage marks the beginning of the infants effective orientation to the external world.	-Continues bodily centered sensations. -Fails to follow rapid movements of persons and objects. -No search for lost objects.
IV. Secondary Circular Reactions (9-12 months)	The beginnings of intentionality are seen in the fourth stage, in that the infant begins to coordinate his behavior with respect to the external world in more complex ways. His use of specific ends demonstrates his increasing organization of the world. He begins to anticipate the effects of his own actions and those of others.	-Fails to visually attend to objects or persons or imitate movements. -Fails to realize similarity in objects, thus does not generalize old schema to new objects. -Cannot see a distant goal to attain it.

		-Fails to perceive of self in relation to environment. -Less likely to initiate interaction with adult to repeat an action.
V. Tertiary Circular Reactions (12-18 months)	In this stage, the infant's behavior clearly involves active trial and error experimentation on the world. His behavior becomes more flexible in that he can systematically vary his actions to obtain a specific goal. He seems to seek novelty for the sake of learning more about the world.	-Fails to see relationships between action and solution that can be accomplished to produce activity. -Less problem solving in environment. -Fails to attack barriers to secure toys. -Fails to see the usefulness of tools to assist in securing goals.
VI. Invention of New Means through Mental Combination (18-24 months)	This stage marks the beginning of internalized thought. The child needs no longer engage in overt trial and error behavior but rather can think about possible behaviors and the effects that they would have. According to Piaget, this stage is a landmark in that it frees the child from his own perceptions and behaviors. He begins to be able to imagine behaviors and their consequences.	-Delayed in internalization of action schema. -Cannot categorize objects by salient dimensions. -Does not pretend by imitating adult behavior previously observed.

developmental and quantitative differences in the early smiling behavior of blind infants and sighted infants. Separation anxiety, a measure of attachment, usually emerges in sighted infants in the first year of life. Fraiberg reported it did not typically occur in her study until the second and third years (Fraiberg & Freedman, 1964).

The blind child is more dependent on his family, and more particularly his mother, than the sighted child for stimulation and social reciprocity. If a close bond develops between the child and a significant other, the possibility of concomitant emotional disturbance is significantly less (Hallenbeck, 1954). At the same time, the parent-child interaction must mature in a manner that fosters the child's acquisition of behavior expected of the age group.

Several common factors have been reported in the early lives of blind children who fail to develop appropriate social and emotional responses. The attitude of the parents toward the child is critical. The parents' ability to accept the child's handicap (Lairy & Harrison-Covello, 1973) plays an identifiable role in the child's emotional development. The parents convey to the child how they view him, the child perceives himself like the parents see him, thus he becomes the image they project. Mayadas and Duehn (1976) investigated the relationship between role expectations and performance in blind individuals and found parent expectations accounted for the largest amount of the total variance.

Fraiberg and Freedman (1964) reported deviant blind children spend hours in bed, in a chair, or lying on the floor, mouthing objects. When human contact is often initiated by biting, clutching, and clawing with the hands, the mouth remains the primary receptor organ, and a developmental arrest seems to take place on a level of mouth primacy and nondifferentiation. The behavior described led the authors to conclude that ego formulation had been impeded during the critical period of nine to eighteen months.

The findings reported on early childhood development seem to bear out findings from Bauman and Yoder's (1966) study of vocationally successful and unsuccessful blind adults. The more self-sufficient and mobile individuals came from families that did not make a big issue of the fact of blindness; family relationships tended to follow the patterns that would have followed if the individual had normal vision.

ASSESSMENT OF VISUALLY IMPAIRED INFANTS

Unfortunately, most psychologists and diagnosticians are not aware of the effects of visual loss on the development of the child. Most of the assessment tools available are of little help in providing tasks that can be administered to the child without risking penalty because of visual impairment. The examiner is also faced with the problem of understanding how efficiently the child uses his vision. This is an important variable in selecting and adapting tests and tasks.

A number of environmental factors are also important considerations when testing visually handicapped children. Placement of the child at the table for maximum use of vision is important. Lights should not fall on the child but from various angles, in order to minimize glare and shadows which interfere with visual efficiency and provoke physical fatigue.

The appendix contains a list of formal measures that can be used with visually impaired preschool-aged children. Many require a functional use of vision; others include subtests that are not appropriate; some tasks must be adapted to provide tactile or auditory input that will enable the child to receive input as to the task, yet not provide additional cues to solutions. Because adaptations are necessary, it is imperative that many tests be used, adaptations be noted, emphasis be placed on the discovery of behaviors currently in the child's repertoire, and information be recorded in a way that will permit a future examiner to compare current results with future performances.

APPENDIX
TESTS FOR USE WITH PRESCHOOL VISUALLY IMPAIRED CHILDREN

Test	Age Range	Domain	Skills Assessed
Developmental Activities Screening nventory (DASI) Teaching Resources 50 Pond Park Road Hingham, MA 02043	6-60 mo.	Screening of Cognitive Development	A teacher-administered screening instrument to determine general cognitive-adaptive functioning levels, accompanied by developmental activities suggestions. This instrument includes specific instructions on how to adapt materials for use with visually impaired children.
Maxfield-Buchholz Scale of Social Maturity for Preschool Blind Children American Foundation for the Blind, Inc. 15 West 16th Street New York, NY 10011	0-72 mo.	Screening of Social Development	Adaptation of the Vineland Social Maturity Scale for blind children. This scale of social development evaluates children in areas of general motor development, dressing, eating, locomotion, socialization, communication, and occupation.
Callier Azusa Scale Callier Center for Communication Disorders 1966 Inwood Road Dallas, TX 75235	0-84 mo.	Screening of General Development	Provides for assessment of socialization, daily living skills, motor development, perceptual abilities, and language development. An observation model is used.
Ordinal Scales of Psychological Development Uzgiris, I. C., & Hunt, J. McV. *Assessment in infancy: Ordinal scales of psychological development.* Urbana: University of Illinois Press, 1975.	0-24 mo.	Cognitive Development	Series of 6 ordinal scales, based on Piagetian observations of sensory-motor schemata. Concerned with the hierarchical interrelationship of achievements at different levels. Six scales include visual pursuit and permanence of objects, development of means for obtaining desired environmental event.
Bayley Scales of Mental Development Psychological Corp. 757 3rd Avenue New York, NY 10017	0-30 mo.	Cognitive Development	Similar to Cattell. It includes separate motor and social scales in addition to a mental scale.
Infant Intelligence Scale Psychological Corp. 757 3rd Avenue New York, NY 10017	0-30 mo.	Cognitive Development	Contains manipulative tasks for determining sensory motor development, including imitation, problem solving, and a few language items.

Merrill-Palmer Scales of Mental Development Stoelting Co. 1350 S. Kostner Avenue Chicago, IL 60623	18-71 mo.	Cognitive Development	The scales assess not only the child's cognitive abilities, but expressive and receptive language and fine and gross motor skills. Comprised largely of performance items, some of which are timed. Provision is made for a child's refusal of an item.
McCarthy Scales of Children's Abilities Psychological Corp. 757 3rd Avenue New York, NY 10017	30-102 mo.	Cognitive Development	An instrument to measure general cognitive functioning, as well as child's strengths and weaknesses in verbal and perceptual performances. Quantitative, memory, motor development, and laterality skills also are examined.
Wechsler Preschool and Primary Scale of Intelligence (WPPSI) Psychological Corporation 757 3rd Avenue New York, NY 10017	48-78 mo.	Cognitive Development	The verbal subtests usually given to blind children include: Information, Comprehension, Similarities, Arithmetic, and Vocabulary. The supplementary subtest of sentences is also useful with this population.
Sequenced Inventory of Communication Development University of Washington Press Seattle, WA 98105	4-48 mo.	Language Development	Receptive and Expressive scales permit examiner to assess the child in an informal play atmosphere.
Receptive Expressive Language Assessment for the Visually Impaired S. Raynor Ingham Intermediate School Dist. Mason, MI	0-72 mo.	Language Development	An adaptation of the REEL for preschool blind children.
Inner Language Scale Rebecca F. DuBose EEU, WJ-10 University of Washington Seattle, WA 98105	0-24 mo.	Language Development	The way in which a child responds to objects and environmental stimuli is assessed on this scale, based on Piagetian theory.
Developmental Sentence Analysis Lee, L. L. *Developmental sentence analysis*. Evanston, IL: Northwestern University Press, 1974.	24-83 mo.	Language Development	Analyzes children's spontaneous speech samples into eight major syntactic categories to derive a sentence score comparable to normal language development.
Laura Lee's Developmental Sentence Types (See above)	Pre-syntactic Formations	Language Development	Analyzes children's spontaneous speech into early developing pre-syntactic structures based on single and two-word combinations, and elaborated constructions.

APPENDIX (Continued)

Test	Age Range	Domain	Skills Assessed
Environmental Pre-Language Battery Charles E. Merrill 1300 Alum Creek Drive/ Box 508 Columbus, OH 43216	Early Communication Stages	Language Development	A series of diagnostic procedures for the nonverbal client. Assesses semantic and cognitive requirements for language through attention, gestures, imitation, play, comprehension, and single words.
Environmental Language Inventory (See above)	One and two-word utterance level	Language Development	A diagnostic and treatment model that assesses early semantic-based grammar through imitation, conversation, and play. Provides extensive data on early experimental parent-based programs using the ELI design and adaptations to total communication, later language on classroom use.
Peabody Developmental Motor Scales Monograph #25 IMRID Publications Box 154 George Peabody College for Teachers Nashville, TN 37203	0-84 mo. 0-72 mo.	Motor Development	An instrument for use in assessing gross and fine motor development. The scoring section allows the child credit for minimum success rather than a pass or failure. The scales are accompanied by developmental activities for each area assessed.
Peabody Mobility Scale c/o Randall K. Harley Box 36 Peabody College Nashville, TN 37203	48-167 mo.	Motor Development	Scales and intervention materials for multiply handicapped blind children in the areas of basic motor, sensory, conceptual, and mobility skills.
Lakeland Village Adaptive Behavior Grid Lakeland Village Medical Lake, WA 99022	0-72 mo.	Social/ Self-care	Allows the evaluator to derive developmental levels for areas such as eating, grooming, dressing, mobility, recreation, socialization, and behavior control, all of which are task analyzed.
Adaptive Behavior Inventory for Children Psychological Corp. 757 3rd Avenue New York, NY 10017	5-11 yr.	Adaptive Development	7 subscales, 24 items, including family role performance, student role performance.

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ASSESSMENT OF THE YOUNG HEARING-IMPAIRED CHILD

Marie Thompson

Intensive investigation over the past several years in medicine, biology, linguistics, psychology and other areas has provided data which identify the existence of critical periods of learning in the early years following birth.

Northern and Downs (1974) describe the importance of critical periods:

> There are certain periods in development when the organism is programmed to receive and utilize particular types of stimuli. Subsequently, the stimuli will have gradually diminishing potency in affecting the organism's development in the function represented. In the case of audition, it means that at a certain developmental stage auditory signals will be optimally received and utilized for important activities, but once this stage has passed the effective utilization of these signals gradually declines. Language input also must be experienced at a certain stage, or it becomes decreasingly effective for utilization in emergent language skills. (p. 71)

Research has demonstrated that even mild hearing losses can cause measurable and permanent impairment (Goetzinger, Harrison & Baer, 1964; Holm & Kunze, 1969; Lewis, 1976; Quigley, 1970; Webster & Webster, 1977) and that language abilities of the hearing-impaired are dependent upon the age at which the hearing impairment is identified and management/intervention strategies are begun (Hayden & McGinness, 1977).

Early assessment and identification of the handicapping condition(s) are also necessary in implementing a support program for parents, who often search continuously for a cure rather than working on development of a meaningful relationship with their child as well as increasing the skill areas necessary for further development.

ESTABLISHING ASSESSMENT GOALS

It is extremely important that anyone who is either requesting an assessment for a child or is actually performing the assessment be aware of why the assessment is taking place. The major purpose for any assessment should be to assist in developing the total management plan for each child.

The first part of the assessment should concern itself with whether or not a hearing loss exists and if so, to what degree. Additional information should be gathered regarding amplification. Additionally, it is necessary to assess in order to determine areas of strength and to determine if other deficits exist beyond the hearing loss itself. It is essential that, in a very young child, hearing loss is not evaluated in isolation but rather that other areas such as cognition, communication, self-help skills, motor skills and social skills are evaluated as well and that results of these assessments are reviewed together in order to establish priorities and to plan the most effective intervention strategies for each child.

HOW TO ASSESS

In order to assess the young child appropriately, it is essential to have a good working knowledge of normal developmental patterns since normal behaviors are used both in the assessment process and in management procedures. Although all children will not develop behaviors at exactly the same time, research supports the fact that there are normal ranges of development and that patterns of sequential steps are the same, although perhaps slower in some children.

HEARING: BEHAVIOR ASSESSMENT

In the initial stages of assessment, it is critical to utilize the knowledge and help of the child's parents. It is very helpful to ask questions relating to the child's behaviors since responses will help corroborate the actual testing results. Table 1 contains questions (Northern & Downs, 1974) that relate to hearing, communication and development from two months to twelve months which can provide very useful screening information to both parents and examiner. For example, if the parents respond "no" to the questions relating to hearing and "yes" to the communication and development questions, this suggests that although the child may have a hearing loss, she is developing normally in other areas since these milestones are

TABLE 1
SCREENING QUESTIONS FOR PARENTS AND EXAMINER

Source: Northern & Downs, 1974

Age	Hearing	Development & Communication
2 months	-Have you had any worry about your child's hearing? -When he's sleeping in a quiet room, does he move and begin to wake up when there's a loud sound?	-Does he lift his head when he's lying on stomach? -Does he smile at you when you smile at him? -Does he move both hands together in the same way? -Does he look at your face without your making gestures at him?
4 months	-Have you had any worry about your child's hearing? -When he's sleeping in a quiet room, does he move and begin to wake up when there's a loud sound?	-Does he lift his head up to 90 degrees and look straight ahead? -Does he touch his hands together and play with them? -Does he laugh and giggle without being tickled or touched? -Does he coo to himself and make noises when he's alone?
6 months	-Have you had any worry about your child's hearing? -When he's sleeping in a quiet room, does he move and begin to wake up when there's a loud sound? -Does he turn his head toward an interesting sound or when his name is called?	-Does he lift up his head and chest with his arms? -Does he keep his head steady when sitting? -Does he roll over in his crib? -Does he reach for objects within his reach and hold them? -Does he see small objects like peas or raisins?

TABLE 1 (Cont'd)

Age	Hearing	Development & Communication
8 months	-Have you had any worry about your child's hearing? -When he's sleeping in a quiet room, does he move and begin to wake up when there's a loud sound? -Does he turn his head directly toward an interesting sound or when his name is called? -Does he enjoy ringing a bell or shaking a rattle?	-Does he support most of his weight on his legs? -Can he sit alone unaided for 5 minutes? -Can he sit and look for objects that have fallen out of sight? -Can he pick up two objects, one in each hand? -Can he transfer an object from one hand to the other? -Can he feed himself a cracker? -Does he make a number of different sounds and change their pitch? -Does he clap his hands in imitation and make noises at the same time?
10 months	-Have you had any worry about your child's hearing? -When he's sleeping in a quiet room, does he move and begin to wake up when there's a loud sound? -Does he turn his head directly toward an interesting sound or when his name is called? -Does he try to imitate you if you make his own sounds?	-Does he play peek-a-boo with you? -Can he stand for at least five seconds, holding onto crib or chair? -Does he try to hold onto a toy when it's pulled away? -Is he shy or afraid of strangers? -Can he pull himself to standing position alone?
12 months	-Have you had any worry about your child's hearing? -When he's sleeping in a quiet room, does he move and begin to wake up when there's a loud sound? -Does he turn his head toward an interesting sound or when his name is called? -Is he beginning to repeat some of the sounds that you make?	-Can he pick up a raisin or a pea? -Can he get into a sitting position without help? -Does he wave bye-bye or pat-a-cake when you tell him to? -Can he say "mama" or "dada"?

present in normal deaf babies. If the answers to all or most questions are "no," it suggests that there are defects beyond the hearing loss and extensive testing in all areas will be mandatory. Once behaviors have been discussed with the parent or parents, testing can begin using behaviors listed in Table 2.

TABLE 2
AUDITORY BEHAVIORS IN NORMAL HEARING CHILDREN

Age	Behavior
0 - 3 months	Startle response to loud sounds (whole body, Moro reflex, tightening of eyelids, etc.); wakes from sleep
3 - 6 months	Begins to respond to softer sounds; quiets to sounds, especially mother's voice; may begin to turn to voice when mother is in same room, talking
6 - 8 months	Localizes to sound -- side to side; i.e., turns head to locate sound; will respond to soft sounds; shows interest in musical toys, rattles, etc; begins localizing to distant sounds
7 - 9 months	Localizes to side, and incidentally begins to look towards sounds below
9 - 13 months	Localizes to side and below
13 - 16 months	Localizes to side, below, and incidentally above
16 - 21 months	Localizes specifically to sounds to side, below, above
21 - 24 months	Locates directly a sound at any angle

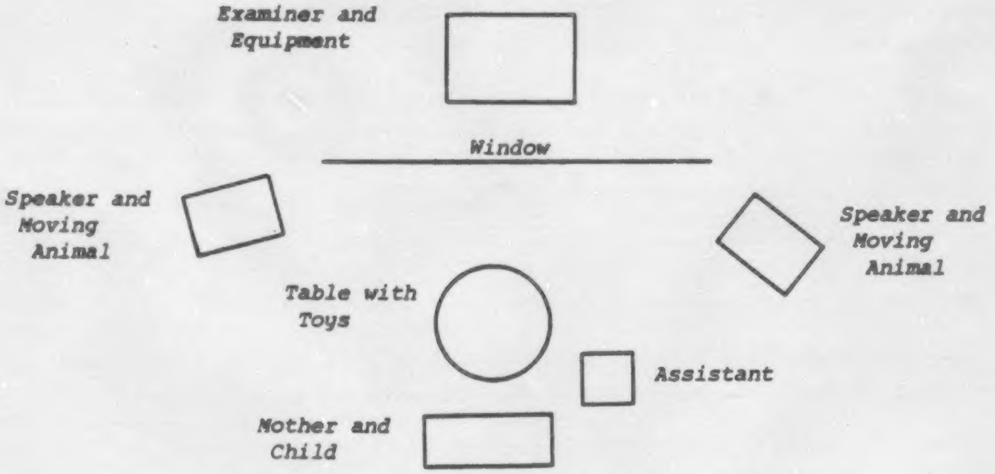
When attempting to assess the hearing of a birth to three-month-old infant, it is important that the testing environment be very quiet. Best results will be obtained if the infant is in a quiet, drowsy state. Most often, the infant is held by the mother as she sits in a specifically designed sound-attenuated booth. After baseline behavior is observed and the infant quiet, a loud raucous broad band noise is presented through loudspeakers. The anticipated response would be a jerking, flailing, whole body movement, occasionally a tightening of the eyes, or even crying. Sufficient time must be allowed between presentations of the noise in order to avoid habituation (lack of responding) to the stimulus. The whole body, Moro response may not appear in infants who are severely developmentally delayed or it may appear too often (i.e., demonstrating no habituation, which may be indicative of central nervous system damage). If the infant is slightly fussy, he may suddenly become very quiet when the noise is presented. Such responses must be observed two or three times when the noise is presented at the same loudness level in order to be considered valid. Obviously, if no responses are observed, the likelihood of a hearing loss is substantial, especially if the parent information is supportive.

During the three- to six-month period, we can use the infant's responsiveness to quiet sounds, mother's voice and various noisemakers by presenting these within the same room and looking for some searching behavior and the beginnings of localization. Various sounds, including mother's voice, may also be presented via loudspeakers so that intensity can be controlled. Responses to look for are quieting, alerting or searching.

By the time the baby is six months old, behaviors are more advanced and assessment becomes easier. Techniques are based upon the infant's ability to localize to sound; i.e., turn his head from side to side in order to find the sound source. The most successful technique at this age is the use of a combination of visual and auditory stimuli. By using visual apparatus first as part of a paired stimulus, then as a reinforcer, a young child's attention can be maintained for long periods of time and precise information obtained. This is set up as follows: The examiner and equipment are in one room, the mother, child, assistant, speakers and moving visual apparatus in another (see Figure 1). The examiner presents a sound paired with a moving animal.

The infant turns to see the moving animal. When the moving animal and sound cease, the assistant plays with the child using soft, quiet toys, keeping the child's attention directed towards a midline position. After the child has learned to look towards the paired stimuli, the sound alone is presented. If the child turns to the appropriate side, for the sound alone, the animal is activated and the child permitted to see the animal move because he turned towards the sound. After hearing levels have been established in a

FIGURE 1
PHYSICAL ARRANGEMENT FOR ASSESSMENT



sound field (sounds presented through the speakers), headphones may be placed on the child and the same technique used to establish information about hearing in each ear individually. This technique can also be used to obtain information about hearing aids. With the aids in place, the child should turn towards sounds that are much softer than before.

As the child reaches two years and older, he can be taught to respond to sound by using play techniques. Thus, when sounds are presented either through the loudspeakers or earphones, the child is taught to put a block in a container, a ring on a spindle, etc., in response to a sound. The important point is that infants and children can be tested and results can be obtained which can contribute significantly to management planning. It is important that physicians do not tell parents that children cannot be tested until they are four or five years of age. It is also important that you who are working with suspected hearing-impaired children not accept statements from audiologists that a given child is "untestable." Keep searching until you find an audiologist who has knowledge about and is capable of working with very young children.

Applications

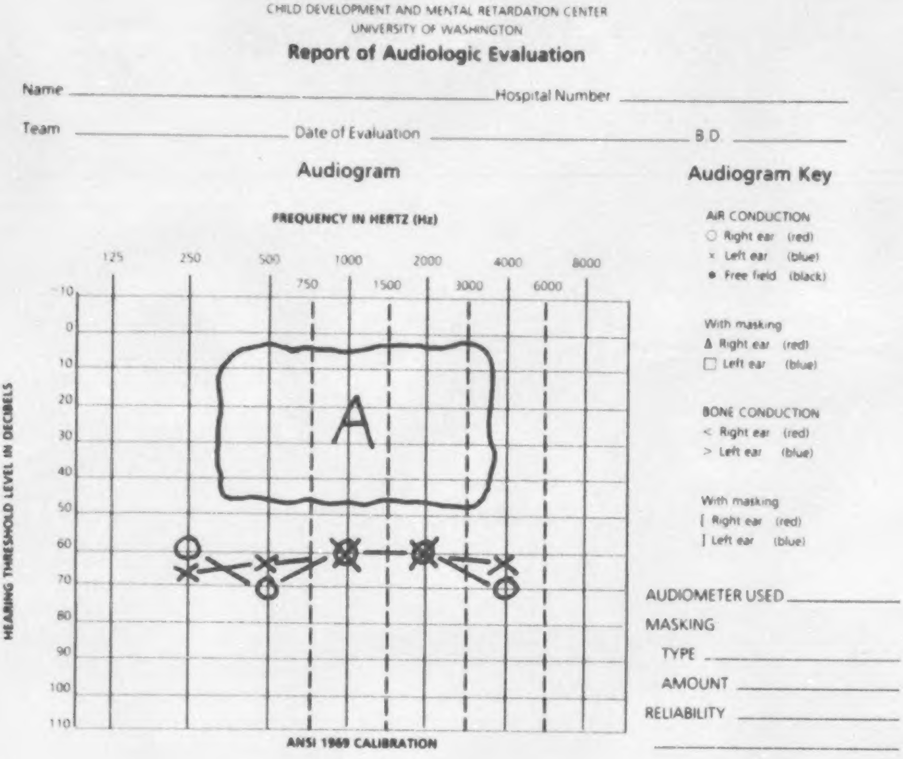
Depending upon what type of testing was done, you will see different kinds of marks on the audiogram (Figure 2). As you move from left to right across the audiogram, the sounds represented are low pitch (left) to high pitch (right). From top to bottom represents soft (top) to very loud (bottom). In the midsection (A), are the most important frequencies for speech. The more this area remains intact, the easier it is for the child to hear and discriminate. If a child has been tested using pure tones and earphones, then red circles will provide information about the right ear and blue X's will provide information about the left ear. Obviously, the lower down on the audiogram all of the marks are, the poorer the hearing ability of the child. If a child is tested in a sound field (through loudspeakers), a variety of marks are used to signify results on the audiogram but there should also be a written comment or "KEY" to indicate what the symbols stand for. Asterisks are often used to indicate results of testing with the hearing aid(s) on but if several hearing aids are tested, several different marks (symbols) may be used. These marks will often show significantly better results than those obtained without the aid(s). However, you must realize these aided symbols reflect only responses to pure tones and do not tell you a child will respond to speech nor how he will learn language via the auditory system.

HEARING: OBJECTIVE ASSESSMENT

Although it is possible to learn more that will contribute to direct intervention plans through the use of behavioral assessment, there are times when behavioral techniques are simply not appropriate and objective techniques are needed to determine the presence or absence of a hearing loss. Of all nonbehavioral techniques, two have emerged as commonly used audiologic procedures: impedance audiometry and brainstem-evoked response (BER) audiometry. Brainstem-evoked response audiometry is an electrophysiological technique which does not require a behavioral response from the infant or child. The child must, however, remain relatively quiet in order for responses to be obtained. If the child is very active, sedation may be required. The procedure requires that surface electrodes be placed on the child, and sound is introduced either in a sound field or under earphones. The "responses" from the child are picked up through the electrodes and recorded automatically on a graph. After a series of presentations of sounds, results are computerized and can be interpreted. Under

FIGURE 2
AUDIOGRAM EXAMPLE

Adapted from: Child Development and Mental Retardation Center
University of Washington



CHILD DEVELOPMENT AND MENTAL RETARDATION CENTER
UNIVERSITY OF WASHINGTON

Report of Audiologic Evaluation

Name ______________________ Hospital Number ______________

Team ______________ Date of Evaluation ______________ B.D. __________

Audiogram

Audiogram Key

AIR CONDUCTION
○ Right ear (red)
× Left ear (blue)
● Free field (black)

With masking
Δ Right ear (red)
☐ Left ear (blue)

BONE CONDUCTION
< Right ear (red)
> Left ear (blue)

With masking
[Right ear (red)
] Left ear (blue)

AUDIOMETER USED ______________
MASKING
TYPE ______________
AMOUNT ______________
RELIABILITY ______________
____

FREQUENCY IN HERTZ (Hz)
125
250
500
1000
2000
4000
8000
750
1500
3000
6000
-10
0
10
20
30
40
50
60
70
80
90
100
110
HEARING THRESHOLD LEVEL IN DECIBELS
A
ANSI 1969 CALIBRATION

ideal conditions, brainstem procedures are used as back-up or are complementary to behavioral techniques. BER provides information only about frequencies at 2000Hz and above. Because most hearing losses have their greatest severity at frequencies above 2000Hz, BER may overestimate the magnitude of the loss. That is, better hearing at lower frequencies will not be noted. In rare instances where hearing is markedly poorer for low frequencies than for the higher frequencies, BER would underestimate the magnitude of the hearing loss. In spite of these limitations, BER does assist in identifying hearing loss and making plans for intervention/management.

Impedence audiometry is used to assess aspects of the physical state of the auditory system. Two variations of impedance audiometry are commonly used. They are tympanometry and measurement of the acoustic reflex.

Tympanometry measures compliance of the tympanic membrane as a function of varying air pressure in the external ear canal. A normal tympanic membrane shows greatest compliance or movement under normal atmospheric pressure. Positive or negative air pressure applied to the ear canal "load" the drum and result in reduced compliance. A normal tympanogram, then, shows peak compliance at normal atmospheric pressure and reduced compliance as air pressure in the canal is varied. In contrast, if there is fluid in the middle ear, no significant change in compliance occurs as air pressure in the canal is systematically varied, thus producing a "flat" tympanogram. Tympanometry has been shown to be a sensitive indicator of middle-ear pathology. In combination with direct physical examination and behavioral audiometry, it represents a powerful diagnostic tool.

The acoustic reflex involves contraction of the stapedial muscle and occurs in most normal ears in response to relatively intense sounds (70-100dB above threshold). The reflex alters the impedance of the middle ear and reduces transmission of sound to the cochlea. With proper instrumentation, impedance changes representing activation of the reflex can be monitored and provide information about the status of the auditory system. Recent investigations have attempted to predict extent of hearing loss by comparing the relative difference in acoustic reflex thresholds obtained to bands of noise and pure tones. While this work shows promise, there can be considerable error in predicting extent of hearing loss from acoustic-reflex data in individual cases. Thus, on a clinical basis, results must be interpreted with caution. The only reasonably safe conclusion which can be drawn at the current time is that if an infant shows acoustic-reflex thresholds, he must have some and perhaps considerable residual hearing.

BEYOND THE INITIAL ASSESSMENT

Once the initial hearing assessment has occurred and the presence of a hearing loss has been established, it is essential to continue assessment until sufficient information is obtained for developing the various intervention strategies and the total management plan. Additionally, if assessment results determine that an infant or young child is developing normally in areas other than hearing, this is extremely important information for the parents to have. Since the identification of a hearing loss is always traumatic, it is critical that any and all positive, "normal" attributes be identified and emphasized to the parent to help them recognize that in most areas, their child is developing normally.

Even with children who have a severe hearing loss and no verbal language, it is important to determine their functional levels in cognitive and communicative areas and to further evaluate their auditory skills, e.g., near-distant responses, loud-soft responses, etc. A variety of assessment tools appropriate to young hearing impaired children are listed in the appendix.

TESTING ENVIRONMENT

In order to obtain the best results in a test situation, it is important not only to select a battery of appropriate tools but also to establish a comfortable environment. Very often, the best results will be obtained by "playing" with the young child on the floor. The point here is that you want to obtain the most information in the least amount of time. It is important also to have established an action plan for the assessment period (e.g., types of materials you will use, how you will control the materials and the child, how to gather information from the parent(s) while you are working with the child, etc.).

Videotapes were made to demonstrate the assessment process for two hearing-impaired children. One child is 22 months old and has a severe bilateral sensorineural hearing loss. The assessment materials being used are the Developmental Profile, which evaluates five areas of development--physical, self-help, social, academic and communication; The Sequenced Inventory of Communication Development; Snyder's Behavioral Descriptions of Performatives; and cognitive behaviors from Uzgiris and Hunt. There are several things to note: (1) mother, child and examiner are all on the floor, (2) mother's help is utilized in eliciting responses during the assessment, (3) materials are kept out of sight except as needed, and (4) questions from the assessment tools are directed to mother while, at the same time, the examiner is working with the child. Using the above techniques will help obtain information about the child's best performance in the least amount of time.

Direct evaluation of concepts demonstrated on the tape show that both children have spatial relationships, causality, object permanence, and means to an end. Thus, in cognitive areas they are both at about a 24-month level which places them well within normal limits. In academic and communication areas, both children are functioning at approximately the one-year level with some scatter, that is to say, both children have motor imitations, some vocal imitations, and appropriate use of the "yes/no" response which are higher than the 24-month level. Although neither has expressive verbal language, each is able to demonstrate the ability to "communicate" via behavioral performatives. For example, the 26-month-old attempts to open a jar and is unable to, shakes her head no, and hands the jar to her mother who opens it. This is obviously a "requesting" communication. The younger child does a great amount of "showing off" vocally and gets her mother to attend to her and laugh and play with her. When mom turns her attention to the examiner, the child gets right in front of mother's face and vocalizes so mom will play with her again.

Also demonstrated on the tapes are various auditory behaviors. Both children are wearing their hearing aids and have been using these aids for several months. The younger child responds very appropriately by localizing to many different auditory stimuli when these are close to her. The older child responds only once to a sound presentation and that is when wooden blocks are banged together very loudly, at very close range.

Because we have information about the child's hearing loss, communication and cognitive skills, as well as other areas of development, we can begin to develop plans for management. With such young children, it is critical that we work closely with the parents also. Since both children have their hearing aids, we would want to make sure that the parents are comfortable with handling them, cleaning them and knowing when they are working properly. The older child needs to work on localization to many different sounds and on receptive vocabulary beginning with names of objects, action words, and then combining the two. Also important would be simple directions, body parts and lots of imitation, both motor and vocal.

The younger child has a great variety of vocalizations and excellent responses to many different sounds, so she could begin to work on discrimination and "distance" listening as well as imitating sounds, simple directions, expanding receptive vocabulary and beginning use of expressive vocabulary.

As you can see, management is based upon all information gathered during assessments, and "next steps" are generated through knowledge of normal developmental data. All programming, therefore, is developed around the needs of the individual child. As work continues with each child and family, it is essential to establish a method for ongoing measurement of both the child's and the family's progress and to constantly update objectives and change goals as progress dictates. It is also critical to assure that reassessments occur on a regular basis in all areas: hearing, hearing aids, cognition, communication/language, as well as other developmental areas.

APPENDIX
ASSESSMENT TOOLS

Rockford Infant Developmental Scales

Developmental scale of receptive and expressive language development, motor, self-help and social development; observer notes if skill is absent, emerging, inconsistent or accomplished. From: Project RHISE, Children's Development Center, 650 North Main Street, Rockford, IL 61103.

Meeting Street School Developmental Scales (Denoff and Hyman)

Determines child's expressive and receptive language abilities (also includes gross motor, visual attention and visual perception). From: Meeting Street School, Providence, RI 02906.

Environmental Pre-language Battery and Environmental Language Inventory

Assesses prelanguage skills such as functional play, motor imitation, verbal imitation and semantic-based verbal communication. From: Nisonger Center, Ohio State University, 1580 Cannon Drive, Columbus OH 43210.

Psychoeducational Evaluation of the Preschool Child

Measures motor coordination, visual-auditory functioning, touch and vision, perceptual association and receptive expression language. From: Grune & Stratton, 111 Fifth Avenue, New York, NY 10003.

SKI-HI Receptive Language Test

Measures comprehension of from one to five critical elements: agent, object, action, attribute and relation, using a pointing response to pictures. From: Project SKI-HI Outreach, UMC 10, College of Education, Department of Communicative Disorders, Utah State University, Logan, UT 84322.

Alpern-Boll

Questions and some behavioral observations to determine child's development (includes language section). From: Psychological Development Publications, 1150 Lakeside Drive, Indianapolis, IN 46278.

Sequenced Inventory of Communicative Development (Hedrick, Prather, & Tobin)

Comprehensive evaluation of child's awareness, discrimination and understanding of speech, and his imitation, initiation and verbal output. Ages 4 months to 4 years. From: University of Washington Press, JA-20, Seattle, WA 98105.

Instruments for Prelinguistic/Nonverbal Children

1. Uzgiris and Hunt Scales
2. Play observations following Lezine protocols.
3. Environmental Pre-Language Battery, Nisonger Center, OSU, 1580 Cannon Drive, Columbus, OH 43210.
4. Behavioral compliance with simple commands; object identification tasks.
5. Coding communication functions: Henry, Coggins, Carpenter descriptors; Snyder descriptors

Definitions

(*American Annals of the Deaf*, October, 1975)

Hearing impairment. A specific term indicating a hearing disability which may range in severity from mild to profound. It includes the subsets of deaf and hard of hearing.

Deaf. One whose learning disability precludes successful processing of linguistic information through audition, with or without a hearing aid.

Hard of hearing. One who generally, with the use of hearing aid, has residual hearing sufficient to enable successful processing of linguistic information through audition.

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INFANT LEARNING PROGRAM FOR DOWN'S SYNDROME

Valentine Dmitriev

In 1886, a British physician named Langdon Down visited a local asylum and observed a number of individuals who were characterized by certain similarities in their physical appearance and general behavior. Intrigued by his observations, Down speculated upon the reason for this phenomenon. Noting that the eyes of these people tended to be slanted and that in profile the nose appeared flattened, reminiscent of Asian features, he concluded mistakenly that the patients were reversions to a primitive racial type of Mongolian origin. He called these individuals "Mongols" (Down, 1886). Even into the following century, the disorder was known as mongolism, and infants born with this condition were called Mongols or mongoloids. This was an unfortunate error that gave rise to a host of unfounded myths and prejudices.

As Smith (1973) points out, in addition to being completely misleading from the point of scientific fact, "there are few physical or mental conditions that are burdened with as many misconceptions as Mongolism." One of the most damaging and stereotyping misconceptions has been the belief that all children with Down's syndrome are hopelessly retarded and unmanageable. As a consequence, less than a decade ago, children born with this disorder were usually institutionalized early in life and denied training and education. Fortunately, in recent years these negative terms have been replaced with the more appropriate and neutral designation of Down's syndrome. One hopes that some of the negative attitudes have been modified as well.

Down's syndrome is a chromosomal aberration that occurs as a result of a genetic error at conception or shortly thereafter. A normal human cell contains 46 chromosomes. All or a portion of the cells in an individual with Down's syndrome contain 47 chromosomes. Genetic errors of this type are not limited to the condition known as Down's syndrome. Nondisjunction, as this type of error is called, can and does occur with any one of the 23 pairs of chromosomes found in the human cell. When the twenty-first pair is involved, the fetus develops with three number 21 chromosomes, instead of just two. This abnormality is known as trisomy 21 or Down's syndrome (Hartl, 1977).

Applications

The incidence of Down's syndrome is exceedingly high, occurring in all races and at all levels of society. It occurs more frequently than any other kind of mental or developmental retardation (Smith, 1973). Approximately one child out of 650 live births is born with this anomaly. It is estimated that about 65 percent of fetuses with trisomy 21 are spontaneously aborted in the early stages of pregnancy (Hartl, 1977). The incidence of the disorder is thus even greater than it appears to be when considering only live births.

The exact cause for the nondisjunction that results in Down's syndrome is not known, but there is a positive correlation between maternal age and incidence of this abnormality. Although Donnell, Alfi, Rublee and Koch (1975) found that the mean maternal age for a sample of 306 children with Down's syndrome was 31, they also reported that at or above age 45 the maternal risk of having a child with trisomy 21 approximates 1 in 40.

The word "syndrome" in Down's syndrome designates a recognizable pattern of altered development. Specifically, as it was first observed by Langdon Down, there are a number of distinct physical and mental characteristics associated with the disorder. In terms of education and intervention, the most significant of these are varying degrees of mental retardation; poor muscle tone, resulting in delayed gross motor development; delayed speech and poor articulation; and frequent upper respiratory infections and middle ear infections, which seem to contribute to a higher incidence of hearing impairment than might be expected in a normal population (Wilson, 1978). Approximately 35 percent of these children have congenital heart defects (Kaback & Leisti, 1975). This serious secondary handicap can further impede physical development.

In view of the many problems that can be attributed to the trisomy 21 genetic error, it is not surprising that in the past prognosis for the future development of these children was so extremely pessimistic. However, in a recent study, LaVeck and LaVeck (1977) reported that poor motor development in a child with Down's syndrome does not necessarily indicate a similar degree of delay in cognitive development. In this study, the Bayley Scales of Infant Development were administered to a group of toddlers, consisting of 20 boys and 20 girls. Although there was no significant difference between the mental quotients of the two groups, there was a significant difference between the motor quotients, with the girls showing a distinct advantage. Particularly in the boys, the motor scale lagged by as much as ten months behind the mental scale. On the basis of these data, the authors caution the pediatrician against making an inference based on motor skills about the degree of overall retardation in a Down's syndrome infant. Such an inference could result in serious underestimations of mental competence and readiness for acquiring cognitive skills.

This study supports our observation that deficiencies in motor and language performance can mask a child's potential. In reality, children with Down's syndrome have excellent receptive language and unique visual-perceptual ability. An instructional approach that capitalizes on these strengths can greatly accelerate these children's academic performance (Dmitriev & Oelwein, 1978).

Nevertheless, it is equally true that, without intervention beginning at birth, children with Down's syndrome may show several months' delay in all areas of their development by the time they are 18 months old (Dicks-Mireaux, 1972). Furthermore, it must be recognized that although there is homogeneity in the stigmata of Down's syndrome, there is also great variability within this homogeneity. Just as there is a range in cognitive performance, there is also a range in the degree of physical involvement and the age at which key gross motor skills, such as independent sitting, standing and walking are attained. But above all, it must be remembered that appropriate early training can ameliorate many of these deficits, accelerating development and lessening the discrepancies between potentially low-functioning children and their more capable peers.

One project that has been successful in achieving these goals is the Infant Learning Program for children with Down's syndrome. This program is a component of the programs for children with Down's syndrome which were established at the Model Preschool Center for Handicapped Children, Experimental Education Unit, College of Education and Child Development and Mental Retardation Center at the University of Washington in January, 1971. The programs serve this population from birth to six years. The Infant Learning class serves babies to 18 months of age (Dmitriev & Hayden, 1975).

Although there may still be some controversy over the longitudinal effects of early intervention programs, the rationale for their existence is no longer questioned. Even a cursory review of current literature on early programs for handicapped children indicates that efforts to prevent developmental deficits have been found to be good and necessary. Beginning with the work of such researchers as Skeels and Dye (1939), Dennis (1960), and White (1969) which showed that learning experiences made available during the first days, weeks and months of life may be of crucial importance, the last few years have heralded a virtual burgeoning of programs offering early childhood education. Although the projects vary in their philosophical framework, setting and the type of child served, the common objectives are to help each child function at his maximum potential (Adelson & Fraiberg, 1975; Bricker, Bricker, Iacino, & Dennison, 1976; Hayden & Dmitriev, 1976-77; Heber & Garber, 1975; Jew, 1974; Ramey & Smith, 1977).

According to Barnard (1975), the modality of the intervention is not the important issue. She believes it is more essential to provide the infant with opportunities for successful interaction with his environment. The Infant Learning Program is built upon this premise. Appropriate interaction with the environment is indeed basic to progress. All the same, to be effective a program must also have a strong theoretical base, clearly defined goals, specific assessment and intervention strategies, parent involvement, motivations, staff inservice training, support services, formative and summative data, exportability and dissemination. These important components are incorporated into the Infant Learning Program and are discussed below.

PROGRAM COMPONENTS

THEORY

The Infant Learning Program is based upon the concept of sequential development. A normal child, especially during the first two to three years of life, develops according to a fairly well defined and predictable timetable. Moreover, each step of his development appears to be geared to allow the child progressively wider and more complex interaction with his environment.

To be successful, this interaction must enable the child to both respond to and to control his environment. Thus if he is able to see, he must be able to respond to what he sees by focusing and fixating. He must be able to control by reaching for and grasping, holding, exploring with hands and mouth, releasing or placing objects on top of or into something. If his world is to make sense, a child must further be able to recognize what he sees and know its function. A baby must learn, for example, that a ball is something to roll, throw, catch or bounce. Later, he must also be able to creep, crawl or walk to retrieve the ball when it rolls away from him. Under normal circumstances, in a favorable environment the child who isn't handicapped will achieve these skills almost routinely, experiencing much more success than failure.

By identifying the sequence of development in the areas of physical, intellectual, social and communicative growth, it is possible to help the Down's infant acquire these skills in an orderly manner, approximating normal development. For example, a child is not expected to walk before he can stand. He is not expected to stand even with support prior to attaining neck and trunk control. As for attending and listening skills, the ability to follow directions is a prerequisite for spoken language. In the areas of eye-hand coordination, a child must be able to reach, grasp and release before he can be expected to manipulate blocks or puzzles successfully.

GOALS

The goal of the Infant Learning Program is to determine each child's individual strengths and weaknesses and to plan systematic intervention strategies. The purpose of these strategies is to remove deficits that interfere with the child's ability to interact with the environment, to maintain attained progress, and to give support and training to the parents.

SETTING

The program is center-based. Parent and infant (birth to 18 months) come to the Model Preschool Center for Handicapped Children once a week for an hour of individualized instruction with their specific teacher. Space is provided where teacher, parent and child may work without being crowded or hampered by distractions caused by other teachers similarily engaged. This could mean one large room with partitioned corners and spaces or several small therapy rooms.

Depending on the child's age, a variety of furniture and equipment is used (e.g., tables are used for very young infants, while older infants are in high chairs, and toddlers have small chairs and tables). Basic materials and equipment include:

- Record sheets
- Assessment materials:
    - Denver Developmental Screening Test
    - Bayley Scales of Infant Development
    - Down's Syndrome Performance Inventory (DSPI)
    - Uniform Performance Assessment System (UPAS)
- Towels and blankets
- Assorted rattles, bells, and tambourines
- Containers of varying widths and depths, one-inch blocks
- Bright colorful toys and objects of varying sizes
- Pegs and pegboard
- Rings and stick
- Picture books
- Marking pens and paper (for scribbling)
- One-piece geometric puzzles (circle, square, triangle)
- Nesting cups and boxes
- Floor mats
- Therapy ball
- Rolls, etc.

ASSESSMENT: FORMATIVE AND SUMMATIVE DATA

Infants are assessed upon enrollment and at regular intervals throughout the school year. Individual programs are based upon these evaluations and ongoing measurements. These activities provide data for formative and summative evaluation of progress.

Assessment Tools	Administration
Denver	Monthly/quarterly
Bayley	Biannually
DSPI	Weekly/monthly/quarterly
UPAS	Quarterly
Performance data	At each session

The Down's Syndrome Performance Inventory (DSPI) consists of a criterion-referenced test and program objectives guide developed by the Down's Syndrome Program staff at the University of Washington. The DSPI is sequentially based upon normal developmental expectations in gross motor, fine motor, personal/social, cognitive and communicative skills for children from birth to eight years. A child is expected to master all the objectives for a given level with 90 to 100 percent accuracy before advancing to the next level. Infants in the Learning Program follow curriculum goals for Level 1.

INTERVENTION

At each session, the infant's progress and deficits are noted. The teacher then helps the parent set weekly developmental goals. Exercises and training procedures are demonstrated and the parent is instructed in continuing the program at home. As the teacher works with the child, the parents are taught to observe and record his responses. These data indicate whether the task was done correctly, and whether with teacher aid or independently. When a baby shows consistent independent performance on a skill, he is advanced to a next slightly more difficult task. Basing curriculum decisions on such data insures maximum opportunity for success, reinforcement, and progress for both mother and child.

A portion of each visit is spent talking to the parents about their infants, answering questions and listening to their concerns. A positive, helpful attitude is necessary in order to give parents optimal support and encouragement.

TECHNOLOGY

Teaching techniques that are used routinely include modeling, cuing, prompting and physically helping an infant make the desired response. The latter, physical shaping, is very effective with Down's syndrome children. Contrary to the tightening or spasticity that frequently occurs in cerebral palsied children when handled, the Down's syndrome subjects readily submit to physical manipulations. Moreover, physical help can be progressively lessened as the child learns to respond independently. This technique has been used successfully in teaching anything from localizing to sound to matching colors and shapes, or crawling and walking.

Another teaching strategy is based upon a hierarchy of discrimination tasks. It is believed that the discrimination of auditory, visual and other sensory stimuli is essential for learning. For example, infants are taught to respond to auditory cues of "look, take, put and give" and to distinguish between objects, colors and shapes. Techniques for teaching discrimination tasks involve matching, selecting, sorting, labeling and generalizing (Dmitriev & Oelwein, 1978).

MOTIVATION

In addition to the careful attention given to sequential development, programming for success and regular recording of a child's performance, reinforcement of desired behaviors is stressed. At the infant level, reinforcement is mainly adult praise and attention. The infant is smiled at, talked to, patted, stroked and generally given a great deal of enthusiastic affection as he is guided through the prescribed exercises. Occasionally a primary reinforcer, such as a piece of cereal, is used when a particularly difficult task is required. Tasks that are difficult and even aversive to many Down's syndrome children are usually those that demand phsyical effort. Due to the general poor muscle tone and frequent weakness in the lower back, it is often very difficult for these children to hold a crawl position with hands and knees on the floor and stomach raised off the floor. Thus a favorite treat may be used as an added reward and incentive for such hard work.

PARENT INVOLVEMENT

Parent participation is absolutely imperative if the handicapped infant is to make the desired progress. It is vital not only because parents must continue the child's program at home, but also because without outside support the parents may be unable to establish a good relationship with their child.

Current research into the dynamics of mother-infant interaction stresses the importance of early bonding (Beckwith, 1976; Deneberg & Thoman, 1976). The birth of a handicapped child, especially one with Down's syndrome identified very shortly after birth, is an event that can seriously disrupt this natural process of bonding. A grieving, depressed mother is unable to interact appropriately with her handicapped baby. And so the infant must cope not only with his inherent disability but with the added burden of maternal rejection as well. It is the author's speculation that the lack of visual contact frequently observed in retarded children may have resulted from a lack of reciprocal regard between mother and neonate rather than the developmental disorder per se.

Mothers, however, are not the only members of a family that need counseling and sensitive support. Fathers hurt too and usually need empathetic guidance along with an opportunity to feel competent and successful with their infants. To this end, a father-infant class meets on Saturday mornings twice a month. The fathers and their

Down's syndrome babies and toddlers meet as a group with a male instructor. The emphasis is on father/child physical and social interaction. Gross motor exercises and music and rhythmic activities are demonstrated. There is also time for adult sharing and discussion. Fathers of new babies frequently seek the advice of men with older infants.

Other members of the family, siblings, grandparents, aunts and uncles are welcomed into the program at every opportunity. Many grandparents appear to be even more deeply grieved by the birth of a Down's syndrome baby than the child's parents. So they too must be given support and tactful recognition of their feelings.

TEACHING STAFF:
INSERVICE TRAINING, SUPPORT PERSONNEL

The staff members for the Infant Learning Program are the same teachers that serve in the Down's syndrome preschool and kindergarten classes. They include a program coordinator, supervisory teacher, and three classroom teachers. All of the staff are certified, and all but one teacher have master's degrees in early childhood/special education. Interns and student assistants participate in the program at a practicum level.

Currently there are 22 infants who come for weekly sessions, and 10 more who live outside of the Seattle area. These field babies attend on a biweekly or monthly basis. In order to serve all of these children, each staff member is responsible for seeing and training several infants.

Inservice training is provided at regular staff meetings, through attendance at conferences and workshops, and through interaction with support personnel. Support services are provided by a physical therapist, communication disorders specialist, audiologist, and nutritionist upon request.

EXPORTABILITY/DISSEMINATION

In 1975, the Joint Dissemination Review Panel (Department of Health, Education and Welfare) validated the Programs for Children with Down's Syndrome as exemplary. Since then the infant and preschool components of the program have been replicated in several locales within the state, nation, and foreign countries, specifically Australia, Canada, and Spain.

Applications

In November, 1978, the Down's Syndrome Congress presented a Meritorious Service Award to the Programs for Children with Down's Syndrome and their project director (Alice Hayden), coordinator (Valentine Dmitriev), and supervising teacher (Patricia Oelwein).

Dissemination is another major goal of the program. In addition to developing instructional materials such as the DSPI, articles for publication, slide shows and videotapes, the senior staff is actively engaged in providing outreach and technical assistance to replication sites. An annual summer workshop held at the Model Preschool Center for Handicapped Children provides training to teachers and parents. Parents and their Down's syndrome infants have come from as far as Nicaragua, Mexico, and Barcelona to receive this instruction.

EPILOGUE

This experience with young Down's syndrome children has been and continues to be especially gratifying, since each new class of infants consistently shows accelerated development. Table 1 compares the development of the children in the Infant Learning and Preschool programs with Gesell developmental norms and the ages at which institutionalized Down's children in New Zealand attained the same landmarks (Share, 1975). Only gross motor and language performance are reported because they are the areas in which these children show the greatest deficits.

It can be seen from Table 1 that, although the Down's Program population lagged behind normal development, their delays are considerably less than those of the institutionalized children. Moreover, as the children get older, the discrepancy between the New Zealand group and the normal as well as the Down's intervention group becomes even greater.

But most encouraging of all is the fact that children who left the Model Preschool Down's Program at age six are still progressing (and at a faster rate) than Down's children who did not have the advantage of early intervention (Hayden & Haring, 1977).

In the fall of 1974, in cooperation with the Special Education Department of Seattle Public Schools and through additional funding made available by the Research Division of the Bureau of Education for the Handicapped, it was possible to initiate a school program for primary-aged Down's syndrome children.

TABLE 1
DEVELOPMENTAL GROSS MOTOR AND LANGUAGE LANDMARKS AND MEAN AGES FOR ATTAINMENT IN NORMAL AND DOWN'S SYNDROME CHILDREN

Motor Landmark	Gesell Norm CA (Months)	Down's Program CA (Months)	N	New Zealand Inst. CA (Months)	N
Sit, head steady 2 min.	3	5.5	23	9	6
Roll to prone	6	8.5	22	11	8
Sits, pivots	12	12.0	18	--	--
Creeps	10	12.0	17	19	18
Pull to stand	10	15.5	14	20	19
Walks w/support	13	18.5	11	26	24
Stands alone	14	18.0	12	26	24
Walks alone	15	25.0	8	29	27
Seats self on chair	18	22.0	10	36	30
Goes up & down stairs alone	24	30.5	6	43	39
Language					
Laughs aloud	4	7.0	25	10	7
Obeys simple command	18	20.5	12	32	29

Eight six-year-old children (1974 graduates of the Down's kindergarten) entered this new Primary program. The Primary classes also included three comparison groups of Down's syndrome children from different types of programs--nursery, preschool, special education, and day care--and those who had not attended any program. The program is still in operation, although since 1977 the project has been expanded to include non-Down's handicapped children.

Data collected for the 1978 progress report show that the children who attended the classes at the Model Preschool Center are functioning statistically better, according to the Vineland Social Maturity and Peabody Picture Vocabulary Test measures, than the children who did not attend these programs. Table 2 summarizes these findings.

In reference to the Social Quotient score for the former Down's Program pupils, it should be noted that, according to Cornwell and Birch (1969), a nine-year-old child with Down's syndrome could be expected to have an SQ only 10 points above his IQ score. Cornwell and Birch also report an average IQ of 35 and an SQ of 32 for comparably-aged children. The data show that the former Down's Program pupils are performing at considerably higher levels on both measures.

What about the future? On the basis of data gathered thus far, it is difficult to predict. One thing, however, seems clear. With early systematic and continuous education, the ugly specter of "mongolism" can be laid to rest as parents and their Down's syndrome children face a brighter tomorrow.

TABLE 2
STANDARD MEAN SQ AND IQ SCORES FOR
FORMER DOWN'S PROGRAM, NON-DOWN'S PROGRAM
AND NON-DOWN'S RETARDED CHILDREN

Subjects	Mean CA (Years)	Mean SQ (Vineland)	Mean IQ (Peabody)	N
Former	8.6	81.5*	54.3*	22
Non-Program	12.1	56.7	44.5	30
Non-Down's	7.1	49.5	46.0	14

*p = .01 significance.

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EARLY INTERVENTION: FROM RESEARCH TO PRACTICE

Craig T. Ramey, Dale C. Farran, and Frances A. Campbell

The general relationship between family characteristics and the development of children is well established: studies have examined the effects of various aspects of the home environment (Bradley & Caldwell, 1976a, 1976b; Elardo, Bradley & Caldwell, 1975; Wachs, Uzgiris, & Hunt, 1971) and parental education and income (Mosteller & Moynihan, 1972), among other family variables, and found them strongly related to the child's performance on standardized tests of development.

These findings, however, should be viewed with some caution since in all but a few studies, the relationships between family variables and children's performance on standardized tests have been obtained with samples which were heterogeneous with respect to socioeconomic status (SES) and may not represent variable processes at work within given SES levels. Evidence exists to demonstrate that low SES homes differ in many ways from middle SES homes: in parental attitudes (Ramey & Campbell, 1976), in the organization of the home (Ramey, Mills, Campbell, & O'Brien, 1975), and in the parents' behavior with their children (Hess & Shipman, 1967; Ramey & Mills, 1977). Sufficient evidence also exists to demonstrate that by the age of two, children from low SES backgrounds are beginning to score lower on standardized tests of intelligence (Golden & Birns, 1968; Golden, Birns, Bridger, & Moss, 1971; Ramey & Campbell, 1977). Thus, it is not surprising that studies with a mixed SES population would find a correlation between family variables and the child's development. However, it is far from clear that patterns of relationships found with mixed SES samples continue to hold when the sample is restricted to a single social class. This point is particularly important for understanding factors associated with

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This research was funded, in part, by the National Institute of Child Health and Human Development (grant HD-03110). The assistance of Neal Finkelstein, Susan Jay, Pamela Mills, Carolyn O'Brien and Kathryn Wilson in the collection of the data is gratefully acknowledged. In addition, we want to thank Mark Appelbaum for statistical consultation. Requests for reprints should be sent to Dr. Craig Ramey, Frank Porter Graham Child Development Center, Highway 54 By-pass, West, Chapel Hill, North Carolina 27514.

subnormal intellectual development which are linked to social and economic disadvantage. Although lower SES families contribute disproportionately more pupils to special education and other remedial programs, the vast majority of children from poor and undereducated families become capable students and self-sufficient citizens. Thus, a focus on the differences between families who produce children who vary in intellectual accomplishments within a particular social class, and especially those who come from the highest risk groups (lower SES), might advance our insight into the specific family variables associated with intellectual development.

Parental behaviors, particularly maternal behaviors in low-income families, have been presumed to be critical for later child success by those who have been forming social policy in the past decade. This presumption has been held in spite of the fact that little longitudinal data are available on the utility of maternal behaviors for predicting the child's later development, particularly within a relatively homogeneous social class group. Nevertheless, early intervention projects for low-income children were begun with the idea either of supplementing the child's home environment through the use of day care (Garber & Heber, 1977; Ramey & Smith, 1977) or of intervening within the home with the goal of making that setting more supportive of normal development (Gordon, 1975; Madden, Levenstein, & Levenstein, 1976).

Recent reviews of early intervention projects (Bronfenbrenner, 1975; Haskins, Finkelstein, & Stedman, 1978; Karnes & Teska, 1975) have all commented on the scarcity of information from these projects concerning their effects on parent-child interactions. At least two major hypotheses are possible concerning the relationship between maternal behaviors and child status where early intervention has taken place. First, programs may succeed in modifying the manner in which mother and child relate to one another as some projects suggest (Gilmer, Miller, & Gray, 1970; Gordon, 1975; Klaus & Gray, 1968; Falender & Heber, 1975).

Second, early intervention programs may alter the relationships between maternal behaviors and child status. This latter hypothesis is a strong possibility for center-based intervention programs where no active attempt to alter the mother's behavior is made. The hypothesis suggests that the mother's behavior may be unaltered with respect to the child, but that it may have less effect on her child's development than it would have for a child who did not experience early educational intervention away from the mother.

This hypothesis also includes the possibility that the child's participation in a program alters the importance of different maternal variables, increasing the importance of some, perhaps, while decreasing others.

In a sense, the two hypotheses can be contrasted as follows: early intervention causes the mother to be different or it changes the relationships between her behavior and the child's performance.

This paper is a report from a longitudinal study conducted to assess the relationships among maternal characteristics at different times and the child's intellectual development in a homogeneous low-income sample and to determine if those relationships are altered by early educational intervention in the form of educational day care.

METHOD

SUBJECTS

The 57 children for this study were identified as belonging to families at high risk for producing children who would become labelled as mentally retarded during the school years. The families were identified by a High Risk Index (Ramey & Smith, 1977) that was administered to the mother before her child's birth.

All 57 of the children were black: 22 were male and 35 were female. At birth, each child was randomly assigned to an experimental or control group. Experimental children attended an eight-hour-per-day, five-days-per-week, center-based day care program from the time they were three months old. Information was collected on both groups throughout the first three years of their lives.

In addition, 14 children and their families were randomly selected from community birth records and recruited to serve as a sample of the general population in the local area against which to measure the progress of the other two groups of children. These general population children tended to come from professional families, but all social classes were represented. Children from the general population sample were followed longitudinally from 6 to 20 months. Table 1 contains a summary of demographic information about the families, and particularly the mothers, of the three groups.

PROCEDURES

For the two high-risk groups, information about maternal intelligence, maternal behaviors and maternal attitudes was obtained as well as the children's performance on the Bayley Scales of Infant Development at 6 and 18 months and the Stanford-Binet Intelligence Test at 36 months of age. Three measures of maternal behavior were acquired:

LABORATORY OBSERVATION OF MOTHER-CHILD BEHAVIOR Mother-child interactions were videotaped when infants were 6 and 20 months in an experimental room equally unfamiliar to all participants.

TABLE 1
DEMOGRAPHIC CHARACTERISTICS OF HIGH RISK FAMILIES AND A COMPARISON SAMPLE FROM THE LOCAL GENERAL POPULATION

Group	Maternal Age	Maternal IQ	Maternal Education	Median Income	Percent Firstborn
Experimental (N=29)	M 18.55 SD 2.54	M 82.86 SD 11.19	M 10.28 SD 1.75	$ 3,250[a]	57
Control (N=28)	M 21.18 SD 6.84	M 81.96 SD 11.83	M 10.18 SD 1.56	3,250	54
General Population (N=14)	M 27.71 SD 3.36	M 114.54[b] SD 15.59	M 15.14 SD 2.54	10,535	57

[a] This figure for the high risk groups is the median income of those parents who reported having income. Of these, 65 percent reported no income upon entry into the program. The means were calculated from midpoints of $1000 ranges.

[b] Based on an N of 13.

The space resembled a small living room and contained a couch, chair, television, small table and lamp, and magazines for the mother. At 6 months, a crib was included in the room. At each age, a set of developmentally appropriate toys was provided. The mother was instructed that we were interested in the child's play with his mother. Observations lasted 25 minutes. Scored from the videotapes for frequency and duration were the following behaviors: (1) mother talking to her child; (2) mother demonstrating a toy; (3) mother touching; or (4) mother holding the child (physical contact). In addition, we recorded (5) mother and child in mutual interaction (either playing together with toys or engaged in a "game" such as peek-a-boo); (6) mother reading to child; (7) mother reading to herself; (8) child playing alone; (9) child vocalizing; and (10) child fussing.

HOME OBSERVATIONS OF MOTHER-CHILD INTERACTIONS The Home Observation for Measurement of the Environment (HOME) (Caldwell, 1970) was used in the home when the children were 6 and 18 months. This inventory consists of 45 items representing six factors or scale scores: maternal warmth and responsivity, absence of punishment, organization of environment, provision of appropriate toys, maternal involvement, and opportunity for variety. Scoring of the items required a combination of direct observation and interviewing. Almost two-thirds of the items were scored from direct observation of the mother-child dyad.

MATERNAL ATTITUDES Emmerich's (1969) revision of Schaefer and Bell's (1958) Parental Attitudes Research Inventory (PARI) was administered to mothers when their children were 6 and 18 months of age. Emmerich's version of the PARI consists of 11 scales which have substantial loadings on three major factors isolated in previous studies of this instrument. These factors are Authoritarian Control, Hostility-Rejection, and Democratic Attitudes.

DATA ANALYSIS

Data analyses were planned to answer the following questions:

1. Did early intervention affect maternal behavior and/or attitudes in each of the three assessment situations? How did the mothers of the day-care-attending children compare to a general population sample of mothers and to high-risk control mothers?

2. Are the factors of intelligence, behaviors, and attitudes in low-income mothers related to children's intellectual status at 3 years? Has early intervention altered the relationships between maternal characteristics and children's intellectual status?

In order to address the major questions posed in this longitudinal study, several analyses were performed. Using multivariate analyses of variance, the three groups of mothers were compared on mother-child interaction behaviors, HOME scores, and PARI attitudes. In all cases, comparisons contrasted the experimental group with the control group and the experimental group with the general population sample. Patterns of change across time were examined for the groups with a repeated measures multivariate analysis of variance (see McCall & Appelbaum, 1973). Stepwise multiple regressions explored the predictive relationships between maternal variables and child status for the low-income samples during the children's first three years of life.

RESULTS

BAYLEY SCALES OF INFANT DEVELOPMENT

The performance on the Mental Development Index of the Bayley Scales of Infant Development at 6 and 18 months of age for the experimental, control and general population samples revealed that at 6 months none of the groups was significantly different from the others. The mean MDI score for experimental children was 106.0 (SD=19.0); for control children it was 103.2 (SD=11.6); and for the general population the mean MDI score was 106.9 (SD=16.8). At 18 months, the groups did differ significantly. Experimental group children were found to score higher (M=100.9; SD=18.1) than control group children (M=89.0; SD=13.2) at 18 months ($t[53]=2.79$, $p < .007$). Bayley scores of experimental group children were not significantly different from those for children in the general population sample (M=106.6; SD=21.6).

LABORATORY MEASURES OF MOTHER AND CHILD BEHAVIORS

Table 2 contains the means and standard deviations of the time in seconds for each of the coded behaviors for the three groups at 6 and 20 months of age. From the laboratory observations of dyadic

TABLE 2
MOTHER-CHILD INTERACTION BEHAVIORS AT 6 AND 20 MONTHS FOR HIGH-RISK CHILDREN AND A LOCAL GENERAL POPULATION SAMPLE

	Groups					
	Experimental		Control		General Population	
Behaviors	M	SD	M	SD	M	SD
	6-Month Observations					
Mother talks	203	176	154	129	368*	206
Mother demonstrates toy	488	279	501	266	678	420
Mother reads to child	6	24	4	12	17	35
Mother reads to self	241	335	278	391	216	336
Mother touches child	258	322	224	319	197	217
Mother holds child	314	405	178	310	272	388
Child vocalizes	102	76	82	71	105	78
Child plays alone	427	364	626	381	550	445
Child fusses	69	117	103	129	38	51
Mother and child interact	536	294	383	284	648	423
	N=27		N=28		N=14	
	20-Month Observations					
Mother talks	133	98	135	173	315*	102
Mother demonstrates toy	244	221	236	265	395	213
Mother reads to child	62	87	21	34	99	110
Mother reads to self	372	365	315	352	149	272
Mother touches child	55	75	61	120	53	42
Mother holds child	27	56	34	130	92	194
Child vocalizes	160	116	130	117	191	148
Child plays alone	853	287	871	333	514*	247
Child fusses	9	19	22	74	21	48
Mother and child interact	418	252	322	300	705*	301
	N=27		N=25		N=14	

NOTE: All time given in number of seconds duration during 1500-second session.

* $p < .01$

interactions at 6 months, results indicated that the high-risk experimental group did not differ from the high-risk control group. The experimental group did, however, differ significantly from the general population sample. The analyses revealed that the only behavior in which the general population sample significantly differed from the high-risk sample was the amount of talking that the mother did to the infant. However, there really was not a great difference at 6 months.

The observations at 20 months indicated once again that the high-risk experimental and control children were not significantly different in their dyads. Moreover, statistical tests showed that the general population sample differed from the high-risk experimental group on more behaviors during the 20-month observational session than at 6 months. General population sample mothers continued to talk more to their toddlers and to interact more with their toddlers, and their children were less often observed playing alone.

HOME OBSERVATION FOR MEASUREMENT OF THE ENVIRONMENT (HOME)

Group differences were also obtained on scores on the HOME, completed when the infants were 6 and 18 months old. Table 3 contains the means and standard deviations for each of the six scale scores as well as the mean and standard deviation for the total inventory. These data are presented separately for the three groups at both the 6- and 10-month assessment occasions.

Multivariate analyses of variance of the six HOME scales and the total score assessed at 6 months indicated there were not significant differences in the home environments of the two high-risk groups. However, the experimental group did differ significantly from the general population sample by multivariate F test, $F(6, 61)=7.17$, $p < .002$. The general population sample had significantly higher scores on each subscale and on the total score.

At 18 months, homes of the children in the general population sample continued to be rated significantly higher than the experimental high-risk group. Statistical tests showed higher scores in the general population sample for five subscales and the total score, but not for the scale Maternal Warmth and Responsivity. The comparison of the two high-risk groups indicated an overall difference between them favoring the experimental group in social desirability.

TABLE 3
HOME SCORES AT 6 AND 18 MONTHS FOR HIGH-RISK CHILDREN AND A LOCAL GENERAL POPULATION SAMPLE

	Groups					
	Experimental		Control		General Population	
Scales	M	SD	M	SD	M	SD
	6-Month Observations					
Maternal warmth & responsivity	6.4	1.8	6.9	2.2	8.6**	1.0
Absence of punishment	5.9	.7	5.6	1.3	6.6*	.9
Organization of the environment	4.7	1.2	4.4	1.2	5.6*	.6
Provision of appropriate toys	4.2	1.8	4.1	1.8	7.5**	1.6
Maternal involvement	3.4	1.4	3.0	1.6	5.4**	1.4
Opportunity for variety	2.0	1.0	1.9	.9	3.5**	1.1
HOME total	26.6	4.7	25.9	5.5	37.4*	4.9
	N=27		N=28		N=14	
	18-Month Observations					
Maternal warmth & responsivity	8.2	1.6	7.3	2.0	8.9	1.4
Absence of punishment	4.3	1.7	4.0	1.4	5.8**	1.3
Organization of the environment	5.1	.9	4.6	1.2	5.8*	.4
Provision of appropriate toys	5.2	1.9	5.5	1.7	8.4**	.9
Maternal involvement	3.1	1.1	2.7	1.6	4.9**	1.5
Opportunity for variety	2.3	.9	2.4	1.2	4.4**	.8
HOME total	28.2	4.5	26.6	5.4	38.1*	4.3
	N=27		N=26		N=14	

* p < .05

** p < .01

PARENT ATTITUDES RESEARCH INVENTORY (PARI)

The high-risk groups did not differ in their maternal attitudes but the experimental group was different from the general population sample. Table 4 contains the means and standard deviations for the factors of Authoritarianism, Hostility-Rejection, and Democratic Attitudes assessed at 6 and 18 months for the three groups.

The results from analyses of the three-factor scores indicated that general population sample mothers were different in their attitudes from the experimental group at the 6-month administration and at the 18-month administration. Univariate analyses showed that

TABLE 4
PARI FACTOR SCORES AT 6 AND 18 MONTHS FOR HIGH-RISK CHILDREN AND A LOCAL GENERAL POPULATION SAMPLE

	Groups					
	Experimental		Control		General Population	
Behaviors	M	SD	M	SD	M	SD
	6-Month Observations					
Authoritarianism	39.6	10.2	39.4	11.4	22.4**	8.5
Hostility-rejection	51.6	6.9	52.7	9.3	57.7	5.8
Democratic attitudes	60.9	6.7	60.1	7.8	70.9**	6.1
	N=28		N=26		N=14	
	18-Month Observations					
Authoritarianism	36.4	9.6	38.0	11.5	19.7**	8.6
Hostility-rejection	55.5	7.5	53.2	9.7	60.9*	4.7
Democratic attitudes	62.9	5.1	62.0	5.5	70.1**	5.8
	N=28		N=26		N=14	

* $p < .05$

** $p < .01$

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at each time the general population sample mothers scored as less authoritarian and as having more democratic attitudes. At the 18-month administration, general population sample mothers also scored as being more hostile and rejecting of the homemaking role. (The Hostility-Rejection factor of the PARI includes scales labelled Irritability, Marital Conflict, and Rejection of the Homemaker Role and may be more a measure of liberated female status than the factor label implies.) The attitudes of the high-risk groups did not differ from each other at either point in time, $F(1, 58) = 16.78$, $p < .001$. Mothers tended to read more to their children at 20 months, and the children tended to play alone more and to vocalize more, F's $(1, 58) > 11.33$, p's $< .001$.

What is presented here is a picture of attributes about mothers which was clearly different for low-income mothers and a representative sample of the local population. Although behaviors and attitudes changed over time, the groups remained significantly different from each other at both points in time. However, as the next set of results makes clear, there was important diversity within the low-income group.

PREDICTABILITY OF CHILDREN'S IQ FROM MATERNAL BEHAVIORS IN THE HIGH-RISK GROUPS

Results of the Stanford-Binet performance at 36 months of age for the experimental and control groups revealed mean scores of 95.9 and 80.6. This difference was significant by t-test comparison. Under the logic of random assignment to groups, it therefore appeared that the day care intervention program resulted in a relatively superior intellectual performance by experimental group children at 36 months of age. Further, the findings indicate that the reason for the group differences appears to be the prevention of intellectual decline in the day care intervention group.

In an attempt to determine maternal predictors related to child status within the high-risk groups, a series of stepwise multiple regressions were performed, with the Stanford-Binet score from the 36-month testing as the criterion variable and maternal behaviors, attitudes, and intelligence as the predictor variables. Given the IQ differences obtained at 36 months, stepwise multiple regression analyses were performed for experimental and control groups.

The analyses demonstrated that different information about the mothers was predictive of later status for the children in each group (see Table 5). For control children, 67 percent* of the variability in Binet scores at 36 months was accounted for by a combination of five maternal variables taken when the children were 6 months old. For the experimental group, predicting from 6 months, 31 percent of the variance in their 36-month test scores was reliably accounted for by three variables in the regression analysis.

Predicting from information gathered at 18 months, plus maternal IQ and the High Risk Index score, the level of reliable predictability went up somewhat for both groups compared to the 6-month data. For the control children a multiple correlation was obtained, accounting for 65 percent of the variance in 36-month Binet scores. The multiple correlation for the experimental group accounted for 49 percent of the variability. It is important to remember that these regression analyses were performed using maternal and mother-child interaction variables. The child's previous developmental status was not included.

It should be noted from Table 5 that maternal IQ was a significant predictor for the control children ($r=.43$, $p < .05$) but that it was not for the experimental children ($r=.09$). It is interesting to note that each domain of data contributed to the regression equations, suggesting that a composite picture of maternal attributes drawn from a variety of sources may yield greater predictive utility than any measures of mothers in a single area. There are several implications to be drawn from these sets of regression analyses:

1. It is possible to predict high-risk children's subsequent IQs within a sample of poverty children from information gathered about their mothers' behaviors and attitudes.

2. Day care intervention within a high-risk group apparently alters the relationships between maternal characteristics and child

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* This R^2 is adjusted for the number of subjects and the number of independent variables; thus, it is a more conservative estimate of the percent of variance explained and was used here because the sample size was small. The formula (Theil, 1971) used to compute the adjusted R^2 is:

$$R^2 - \frac{(k - 1)}{N - k} (1 - R^2)$$

TABLE 5
MULTIPLE REGRESSIONS TO 36 MONTH STANFORD-BINET SHOWING VARIANCE CONTRIBUTED BY VARIABLE

High Risk Experimental					High Risk Control				
Variables	Multiple R	R^2	Beta	F	Variables	Multiple R	R^2	Beta	F
6-Month Information									
Democratic attitudes	.35	.12	.487	5.48**	Physical contact	.54	.30	.664	17.71**
Mother/child interact	.59	.34	.571	8.39**	Maternal IQ	.68	.46	.505	13.35**
Absence of punishment	.63	.40	.266	1.81	Child plays alone	.75	.56	.322	4.19**
					Mother talks	.78	.61	.323	5.25**
					Hostility/rejection	.82	.67	-.275	3.77*
	Adjusted R Square = .31 F(3,20) = 4.41**				Adjusted R Square = .67 F(6,18) = 7.85**				
18-20-Month Information									
Mother talks	.55	.30	.271	2.18	Maternal involvement	.47	.22	1.004	28.06**
Organization of environment	.67	.45	.373	5.48**	Maternal IQ	.53	.28	.905	10.77**
					Child plays alone	.58	.34	1.016	26.98**
Hostility/rejection	.74	.54	-.348	4.77**	Democratic attitudes	.68	.47	-.735	7.05**
Maternal involvement	.75	.56	.260	2.19	High-risk index	.75	.56	.328	2.87*
Mother/child interact	.76	.58	.261	1.91	Mother talks	.82	.67	.582	13.14**
Maternal IQ	.79	.62	-.211	1.74	Physical contact	.86	.73	.492	6.49**
					Absence of punishment	.88	.77	.202	2.25
	Adjusted R Square = .49 F(6,17) = 4.66**				Adjusted R Square = .65 F(8,16) = 6.56**				

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* $p < .05$
** $p < .01$

status. Specifically, maternal characteristics are somewhat less predictive of high-risk children's intellectual development when the children have been enrolled in an early intervention program.

3. It appears that predictive relationships must be established separately for the experimental and control groups. The specific maternal variables leading to prediction for the two groups differed in the regression model; different attributes about the mothers were important for children who attended a day care intervention program compared to children who were untreated.*

DISCUSSION

We have presented here a complex set of results, all addressed to a theoretically and practically important issue: Can one look within an apparently homogeneous social class group -- a group known to be of high risk -- and predict the child's later intelligence from information about the child's mother? The answer from these data is, clearly, yes. Moreover, the level of predictability is remarkably high; one can account for between 50 and 65 percent of the variance in children's 36-month Stanford-Binet scores by knowing only information about their mothers' attitudes, behaviors, and at-home interactions with the children when they were toddlers.

This study was an attempt to dissect the general relationship between low-income families and the typically poor test performance of their children into the specific relationships among variables subsumed within it. For too long, research on social and intellectual development of high-risk children has remained at the level of allowing social class, as a general term, to carry explanatory weight. When one compares the behaviors of the high-risk mothers in this sample with those of a local general population, the behavior of high-risk mothers certainly appears, as a group, to be different.

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* The results presented here are those of two separate stepwise regressions, one performed on each group. No attempt was made to compare regression weights for a given variable across groups for a number of reasons which include: (a) the research question was not one of comparison of differential predictability of a given variable for two different groups but rather one of optimal sets of variables in different groups, and (b) a test of equality of regression weights logically depends on other variables in the systems. The results of this study show that it is not reasonable to include the same set of variables for both groups for optimal prediction.

Low SES mothers were less verbal and less interactive in a laboratory situation; they were less warm and involved at home and maintained more authoritarian attitudes--all characteristics which have been described in previous research. However, the group comparison results are only a part of the picture and, by themselves, can actually be misleading in their simplicity. The patterns of social relationships among low-income mothers and their young children are far from uniform. Even within this apparently homogeneous group there is enormous diversity of attitudes and behavioral styles. That this diversity is important and interpretable is attested to by the multiple regression results.

With this longitudinal research, we have demonstrated that, through a composite picture of the low-income mother drawn from a number of different measures of her behavior, attitudes, economic situation, and intelligence, one can predict a child's development with a fair degree of accuracy. We have also shown that the level of prediction was somewhat lower if the child had participated in an early intervention program. And, perhaps more importantly, the specific maternal attributes which predicted for the experimental intervention group were different from those that predicted for the control group. The two groups of mothers did not fundamentally differ in behavior, attitudes, or intelligence but the relationships of their attributes to child outcome at a later time were quite different depending on whether the child had spent a large part of the day in an intervention program. One of the most striking examples of the different relationships of maternal attributes for the two groups was the relative lack of correlation between maternal IQ and the child's intelligence score for the intervention group. Maternal IQ was a significant predictor variable only for the control group children.

In summary, we think that the findings reported here are important for several reasons. First, they help to establish the importance of maternal variables for predicting a child's intellectual progress and do so without the potentially heavy-handed influence of widely disparate economic and social class factors within a sample. Second, the findings address the alternative hypotheses posed at the outset about the possible effects of early intervention. It appears that a day care-based program does not necessarily alter maternal behavior or attitudes when that is not its goal; however, it does alter the relationships between maternal characteristics and the child's later development. It appears that different maternal characteristics are likely to facilitate development in children who enter an early intervention program compared to children who do not. If these results establish the theoretical point of environmental importance of early parent-child relationships, then we must seek ways to make them applicable to other intervention audiences.

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